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RUN REPORTS: CO_2 ACCEPTOR PROCESS GASIFICATION PILOT PLANT

Final Report, Volume 8, Book 3 of 6, Runs 19–27, June 1974–August 1975

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RUN REPORTS

CO_2 ACCEPTOR PROCESS GASIFICATION PILOT PLANT

FINAL REPORT, VOLUME 8
BOOK 3 OF 6, RUNS 19 - 27
PERIOD: JUNE 1974 - AUGUST 1975

CONOCO COAL DEVELOPMENT COMPANY
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AMERICAN GAS ASSOCIATION
UNDER CONTRACT EX-76-C-01-1734

FOREWORD

The reports contained in this document were prepared jointly by Conoco Coal Development Company and Stearns-Roger, Incorporated, as partial fulfillment of the Department of Energy contract (EX-76-C-01-1734) for the development of CO_2 Acceptor Gasification Process. Each report normally covers the operation of the CO_2 Acceptor Process Pilot Plant for a single run. Some runs, however, have several parts (A, B, C, etc.) and occasionally two or more runs have been grouped together in a single report.

The reports are informal data reports which were written shortly after the completion of the respective runs. The reports serve the purpose of recording the objectives, accomplishments, and problems encountered during the pilot plant operations. Operating data are also often presented. However, these data are, for the most part, presented as a matter of record since the inclusion of heat and material balances and the analysis of the data was not part of the scope of the run reports.

Prior to Run 16, no periods of truly steady-state integrated plant operation were obtained for which heat and material balances can be calculated. The development of a reliable, standardized startup procedure, the solving of process and especially mechanical equipment problems, were the primary concerns during these early runs.

Much needed process data at steady-state conditions were gathered during the later runs. Detailed heat and material balances for selected runs are presented in Volume 12 of the Final Report. Some discrepancies will be found between the data presented in the run reports and the heat and material balance results. For example, the acceptor circulation and gasifier vent rate presented in many of the run reports do not agree with the heat and material balance values.

The run report acceptor circulation rates are based upon the acceptor lift line pressure drop and are considered to be only an approximation of the actual acceptor circulation rate. The pressure drop derived circulation rate served as a guide to the plant operators and provided trend information. Because of the severe temperature and pressure conditions in the process, the acceptor circulation and also the fuel char rates cannot be directly measured. These rates can only be accurately determined via detailed heat and material balance calculations. A mathematical model of the process, which is embodied in the form of a computer program was therefore developed. The model values for the acceptor circulation and the fuel char rates are presented in the detailed heat and material balances. These rates are considered to be correct.

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The measured gasifier vent rates (product gas rates) contained in the run reports are generally lower, and often much lower, than the mathematical model values. There are several reasons for this. First, process flow measuring instrumentation was often fouled by the small amounts of char fines and liquid water contained in the vent gases. Secondly, undetected process leaks from valve packings and from vessel and piping flanges represent sizable losses in the available vent gas quantity to be measured. The actual vent gas from the gasifier is better represented by the mathematical model value than by the measured value.

The above examples point out that consideration must be given and judgements made concerning the use of certain process data. The philosophy with respect to data analysis, has been to use the mathematical model to match as much as possible the measured process data. Differences between the model results and the measured data are resolved by the reexamination of instrument records and the pilot plant logs or by modifying the model where necessary.

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RUNS 19, 20, AND 21

JUNE 5 TO SEPTEMBER 15, 1974

CO_2 ACCEPTOR PROCESS GASIFICATION

PILOT PLANT

RAPID CITY, SOUTH DAKOTA

1 SUMMARY

This report covers the gasification pilot plant operation for Runs 19 (June 5-July 19, 1974); 20 (August 2-August 18, 1974); and 21 (August 30-September 15, 1974). These runs demonstrated for the first time that lignite coal could be used as a pilot plant feedstock. For Runs 19, 20, and 21, the total times logged during which Velva lignite was continuously fed to the gasifier were 150, 75, and 244 hours respectively. While feeding lignite, there was never any evidence that condensable organic materials survived the gasifier conditions. Even for periods during Run 21 when the gasifier char bed temperature dropped to 1460^{o}F, no oils and tars were detected in the gasifier quench system or in any downstream equipment.

The system was also operated for significant periods using only the circulating active acceptor to supply the heat duty for the gasification reactions. These periods without air to the gasifier were 9, 38, and 171 hours for Runs 19, 20, 21 respectively.

A now standard startup procedure was followed in all three runs. The procedure involved using dead-burned dolomite for the initial regenerator inventory and lignite char in the gasifier. After establishing acceptor circulation and operating temperatures in both reactors, the gasifier feedstock was switched to preheated Velva lignite. Fresh active 6 X 9 dolomite was then used to change out the inventory of dead-burned dolomite. As the circulating acceptor activity gradually increased, the air supplied to the gasifier char bed to maintain temperature was reduced. Finally, the air addition was eliminated.

A 1500^{o}F gasifier char bed was always established before raw lignite was fed to the system. This insured that sufficient residence time at temperature in the fluidized char bed was provided to crack and react the lignite volatiles to hydrogen, methane, and carbon oxides.

During Run 19, balance period operating data were obtained for three distinctly different periods. In the first period, gasifier operating conditions were maintained using circulating dead-burned dolomite (11,000 LBS/HR) and air to supply the gasification heat requirements. Husky char was the gasifier feedstock. The second balance period consisted of lining the plant out using Velva lignite as the gasifier feedstock. Again, circulating dead-burned dolomite and air injection were used to supply the necessary gasification heat requirements. For the third period, active acceptor replaced the circulating dead-burned dolomite, and air was no longer used to supply gasifier heat requirements.

Balance periods using Husky char as a gasifier feedstock were eliminated from the startups for Runs 20 and 21 since sufficient data had been accumulated previously. Balance periods were obtained for these runs while Velva lignite was used as a feedstock, and when all gasification heat requirements were supplied by the circulating acceptor. Run 20 featured one balance period while three were obtained during Run 21.

The shutdown causes for Runs 19 and 20 were due to equipment failures. Run 19 ended when a large leak was discovered in the expansion joint on the gasifier side flow line CO-203. Run 20 was ended when the gasifier internal cyclone fell from its support due to the failure of a fillet weld. The cyclone dip leg dropped into the gasifier boot and acted as a draft tube so that a stable interface could not be obtained.

The buildup of an intermediate fines material in the gasifier char bed was responsible for the Run 21 shutdown. The material was composed primarily of calcium, magnesium, and silica ranged in size from -28 to +65 Tyler mesh. Material of this size range is too coarse to be stripped from either the regenerator or gasifier fluidized beds by the overhead gases. The material is also too fine to shower into the gasifier boot where it could be removed from the system with the spent acceptor purge. Therefore, the material gradually built up in the gasifier char bed until the operation of the transition section became unstable. Eventually bridges formed in the gasifier transition and boot sections. Since a stable interface could not be regained because a deposit had formed in the boot section, the plant was shut down.

The equipment failures which caused the Run 19 and Run 20 shutdowns were easily repaired. An expansion joint was replaced and the gasifier cyclone was reinstalled with additional bracing. The solution to the intermediate fines problem will require the installation of a char bed purge system. This should not cause a large thermal penalty to the process. Since the fines build-up rate was estimated to be only four pounds per hour, the char purge will be small.

Present plans are to attempt a short run to determine the feasibility of using 100 percent steam as the fluidizing medium in the gasifier boot. Following this run, the plant will be shut down for a major turnaround during which the char removal system will be installed. Other system repairs include: Regenerator refractory replacement, modifications to the gasifier quench system, and work to tie-in the new methanation facilities.

2 TEST DATA

Runs 19, 20 and 21 data are presented graphically and/or tabularly at the end of this run report. These figures and tables include:

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3 SIGNIFICANT EVENTS AND OBSERVATIONS

3.1 HISTORY OF RUNS 19, 20, AND 21

3.1.1 Purpose

The goal for Runs 19, 20, and 21 was to establish long-term plant operation at process conditions. Velva lignite was to be the gasifier feedstock, while active acceptor was to supply the gasification heat requirements.

3.1.2 Accomplishments

(1) For the first time, raw, preheated Velva lignite was used as the gasifier feedstock in the presence of showering acceptor.

(2) The plant operation demonstrated that all lignite volatile materials were hydrocracked and reacted to form hydrogen, methane, and carbon oxides at the gasifier operating conditions.

(3) Data from which heat and material balances can be calculated were obtained during several steady-state balance periods.

(4) When conditions dictated, air was totally removed as a heat source to the gasifier. All the gasification heat requirements were then supplied by circulating active acceptor.

(5) Additional data were obtained for correlating acceptor circulation rate as a function of the lift line pressure drop.

(6) The metal dusting type corrosion in the gasifier boot heater coils was greatly reduced or eliminated by adding steam to the recycled gas.

3.1.3 Termination Causes

Run 19

The plant was shut down after a large leak was discovered in the expansion joint on the gasifier side flow line CO-203.

Run 20

Run 20 was terminated after the gasifier internal cyclone fell from the supporting gas outlet piping. Since the dip tube protruded into the gasifier boot, an alternate route for the fluidizing gases was provided so that a stable char-acceptor interface could not be maintained.

Run 21

The accumulation of an intermediate fines material in the char bed initiated a gasifier upset which resulted in the plant being shut down.

3.1.4 Mechanical Problems

Run 19

(1) Following the sixth startup attempt for Run 19, the inside diameter surface of the regenerator refractory was found to be in poor condition. Cracks in the refractory and spalled areas had to be cleaned and patched. One area (about 18 X 36 inches) around the fuel char inlet had to be replaced to the vessel metal wall.

(2) Before the regenerator refractor repairs were made, pieces of spalled refractory accumulated on the calcined acceptor control valve, TCV-2030, and caused two shutdowns.

(3) Leaks developed in the expansion joints on the recarbonated acceptor standleg, CD-204, and on the gasifier side flow line, CO-203.

(4) Twice near the end of the run, the gasifier lignite feed line, LN-208, plugged. This was due to the presence of a partial restriction composed of once wet dolomite fines in the line. See Table 19-26 at end of this report for the plug composition.

(5) The lignite grinding system roller mill developed leaks in the plenum chamber when lignite was first ground.

(6) The lignite fines line from the scalping screen plugged numerous times due to steam backflushing from the preheater.

(7) Lignite feed to the roller mill was lost several times due to foreign material in the coal jamming the Redler conveyor.

(8) Several lignite grinding system shutdowns were caused by an electrical failure in the 100 area alarm panel. Once when this occurred, the interlock ESD shutdown system shut off the regenerator flue gas to the lignite preheater. The preheater then defluidized, and the gasifier-regenerator pressure balance was upset.

(9) The lignite grinding system developed numerous leaks. During the shutdown enough air entered the system to

cause a fire in the dust collection baghouse. All bags were damaged and had to be replaced.

(10) Following the run shutdown, cracks were found in the flange of the boot heater outlet line, GR2-205. The flange was replaced with a similar unit from the devolatilizer system.

(11) A hole developed in the inner metal liner of the gasifier tee section, UAD-205. Erosion and corrosion during past and present operations caused the failure at the point at which the preheated gases impinged on the inlet piping. The tee section was replaced with an identical unit from the devolatilizer.

Run 20

(1) Refractory in the engager pot, F-222, spalled around the acceptor makeup line entry point. Since this caused no operating problems, the refractory was not replaced until the run ended.

(2) The regenerator air distributor ring was destroyed just prior to shutdown. There are two probable times during which this could have happened. The first period was just after the gasifier cyclone fell from its support. To maintain the regenerator bed expansion, recycle gas was added to the regenerator air flow. The resulting change in the air heater outlet temperature (1200° to 1500° F) indicates that the combustible components, principally CO, in the recycle flow burned in the heater and downstream piping. During this period the CO content of the recycle gas increased from 1.5 percent to 13.2 percent. The second probable period occurred much later in the run. At the time methane was being used to maintain the regenerator temperature. Since the regenerator was operated under reducing conditions, the methane concentration gradually increased to more than 20 volume percent on the recycle gas. Eventually, methane combustion may have taken place inside the air distributor ring.

Run 21

(1) The lignite grinding section was shut down to repair baghouse blow ring carriage. A bearing was replaced and the carriage drive chain was reinstalled on its sprocket.

(2) A weld which supported the protective liner of the lignite roller mill expansion joint, EJ-100, eroded. The liner fell and lodged on the mill's velocity separator cone. A new liner was welded in place during the run.

(3) Partial restrictions near the regenerator quench tower inlet developed several times throughout the run. At one time when the quench tower inlet was rodded out, the recycle compressor suction increased dramatically from less than 100 PSI to 125 PSI. The problem may have been caused by insufficient water flow to the upstream venturi. Inspection after the run revealed wall scale deposits up to 3 inches thick on the downstream piping between the venturi and the quench tower. One water nozzle in the venturi was plugged with agglomerated dolomite and char ash fines.

(4) The spool piece between the gasifier quench tower, E-301, and the solids separator, F-319, plugged several times causing the quench tower to flood. Pressure upsets occurred when water was carried into the recycle compressor, the vent lines, and into the recycle purge gas dryers.

(5) One end of the shaft in the fuel char butterfly flow control valve, LCV-2002, eroded through. An extension to the shaft was welded on the opposite side from the valve actuator. The actuator was then repositioned on the shaft extension. The use of purge gas blasts into the char standleg to start the char flow probably caused the erosion. This operating practice had been used during this run and in previous runs.

3.1.5 Process Problems

(1) Small deposits of agglomerated dead-burned dolomite formed in the gasifier boot during all runs.

(2) The concentration of an intermediate fines material in the gasifier char bed continually increased throughout the runs.

3.2 CHRONOLOGY OF OPERATIONS

3.2.1 Run 19

Date	Time	Hours Counted	Description
6/5	1400		Began pressuring up system. Air compressor, J-202, used to pressure system with air.

Date	Time	Hours Counted	Description
6/5	1440		System at 150 PSIG. Proceeding with static leak test.
"	2400		Began depressuring to repair leaks.
6/6	1100		Pressuring up with air.
"	1330		System at 150 PSIG. Proceeding with static leak testing.
"	2130		Vent flow tests started.
6/7	0915		Vent flow tests completed. Air removed. Inert gas started to system.
"	1300		Recycle compressors started. Gas circulation tests began. Tee under gasifier plugged.
"	1400		Started depressuring for maintenance.
"	1615		System depressured.
"	1705		Pressuring up system.
"	1810		Recycle compressors started.
"	1830		Heaters lit.
"	2100		Began curing of regenerator refractory.
6/8	1330		Curing period ended. Heating up continued.
"	2220		Heaters up to temperature. Zinc oxide system put in service.
6/9	0100		Compressor capacity tests started. Zinc oxide system bypassed for tests.
"	0400		Steam flow tests started to determine integrity of flow measurements.
"	1830		Steam side flow test ended. Steam boot flow began.
"	2345		Steam flow tests ended.
6/10	0020		Dolomite feed started to gasifier. Dolomite started to regenerator via makeup hopper, F-206.
"	0650		Zinc oxide unit put back on line.
"	0930		Balance gas purge to dPR-2037 plugged.
"	1340		Pressure seal established between regenerator and gasifier reactors.
"	1415		Recycle gas removed from gasifier side and steam introduced.
"	1540		Regenerator dolomite inventory established.
"	1610		Attempted acceptor circulation, had trouble clearing balance gas line on recarbonated acceptor standleg, CD-204.
"	1800		Acceptor circulation started.
"	2000		Circulation stopped for lift line gas flow tests.
"	2200		Started acceptor circulation tests.

Date	Time	Hours Counted	Description
6/11	0345		Circulation lost through calcined acceptor standleg, CD-206.
"	0400-1000		Unable to recover substantial circulation.
"	1100		Began shutdown of system.
"	1645		System depressured.
6/12	0700		Refractory found on top of calcined acceptor flow control valve, TCV-2030. NOTE: This loose refractory found in the system was from old regenerator patches.
"	1850		Pressuring up system.
"	2330		System pressure at 150 PSIG. Vent flow tests completed.
6/13	0145		Balance gas lines and sample points plugged.
"	0350		Depressuring system.
"	1020		Pressuring up system.
"	1145		System pressure at 150 PSIG. Static leak test started.
"	1230		Static test completed. Recycle compressors started.
"	1650		Heaters lit.
6/14	0250		Dolomite feeding to gasifier via lignite lockhopper, F-204A. Gasifier compressor not delivering constant flow. CD-204 plugged above gasifier boot level control valve, LCV-2003.
"	0530		Began shutdown procedures.
"	0930		System depressured NOTE: Water caused plug of agglomerated acceptor located 18 inches above LCV-2003. Solid for 1 foot and had to be chiseled out.
"	1300		Pressuring up of system started.
"	1400		Heaters lit.
6/15	0515		Dolomite feed started to gasifier.
"	0745		Dolomite transferred to regenerator.
"	0815		Dolomite feed to regenerator via V-206 started.
"	1400		Pressure seal between reactors established.
"	1530		Dolomite circulation started. NOTE: Circulation very rough and had to stroke flow control valve, TCV-2030, several times and then set at 9 PSIG air loading for smooth transfer.
"	1710		Air put into regenerator.
"	1750		Dolomite circulation started.
"	1920		Tests ended. Dolomite circulation test started.

Date	Time	Hours Counted	Description
6/16	2135-1445		Dolomite circulation erratic entire time. Attempts to clear line failed.
"	1500		Expansion joint, EJ-2, on line CD-204 leaking.
"	1515		Began shutdown procedures.
6/26	1130		Started pressuring system with J-309.
"	1330		System at 150 PSIG. Static leak tests began.
"	1347		System being depressured due to leak in expansion joint, EJ-2. NOTE: Entire expansion joint replaced during shutdown. Erratic acceptor circulation was due to refractory piece (2-1/2 to 3 inch diameter) on valve TCV-2030.
6/28	1030		Pressuring up system.
"	1500		System at 150 PSIG. Static leak test started.
"	1700		Depressuring to replace pinched pressure tap to FI-2107.
"	1930		Pressuring up system.
"	2200		System at 150 PSIG. Static leak test started.
"	2300		Heater lit. Began regenerator refractory curing.
6/29	2000		Regenerator curing finished. Increasing temperatures.
6/30	0100		Air introduced into side of gasifier.
"	0145		Started air to regenerator. Steam flow tests started. NOTE: The steam tests were run several times because the boot steam flow transmitter, FT-2021, was found to be installed backwards, and a leak was found on the side flow steam transmitter, FT-2302.
"	2205		Started dolomite addition to gasifier. Zinc oxide towers placed in service.
7/1	0215		Dolomite transferred to regenerator.
"	0240		Started dolomite feed to regenerator via F-206.
"	0305		Dolomite again transferred to regenerator from gasifier.
"	1000-1445		Zinc oxide towers switched.
"	1645		Acceptor lift line, CD-208, plugged. Unable to close lift line shutoff valve, XCV-2010.
"	1815		Initiated shutdown procedures. NOTE: Packing on valve XCV-2010 was too tight.
7/2	0545		System depressured.
"	1630		Pressuring up system.

Date	Time	Hours Counted	Description
7/2	1715		System at 150 PSIG. Began static leak test.
"	2215		Started compressor flow tests.
"	2230		Heaters lit.
7/3	1000		Dolomite feed started to gasifier via lignite lockhopper, F-204A. Zinc oxide unit put in service.
"	1230		Lignite feed lines to gasifier plugged.
"	1630		Feed lines cleared.
7/4	0215		Started solids circulation after regenerator filled.
"	1400		Flow tests completed. Char addition started.
"	1430		Dolomite makeup started to regenerator at 300 LBS/HR.
"	1530		Steam introduced to gasifier side.
"	1849		Air added to gasifier side and some steam removed.
"	2000		Char standleg sealed.
"	2130		With char bed established, transferred char to regenerator for 5 minutes.
"	2200		Started dolomite circulation.
"	2240		Introduced steam to gasifier boot.
"	2325		Began regenerator char combustion.
"	2350		Char transfer stopped.
7/5	0245		Fuel char feed erratic.
"	0400		Char transfer improving.
"	1645		Unable to dump to spent acceptor purge hopper, F-213. Initiated shutdown procedures.
7/6	0700		System depressured to clear line.
"	1645		Began pressuring up.
"	1715		System depressured to repair leaks.
"	1830		Pressuring up.
"	1930		Compressors and heaters started.
"	2345		Zinc oxide unit put in service.
7/7	0530		Filling regenerator via F-206. Air taken out out of regenerator.
"	1700		Lift line flow test started.
"	1800		Started dolomite circulation test.
"	2025		Steam introduced into gasifier side.
"	2030		Char feed started to gasifier. Air taken out of regenerator.
"	2120		Acceptor circulation started.
"	2200		Withdrawing acceptor to purge lockhopper, F-213, continually. Air started to gasifier.
"	2325		Began char transfer to regenerator. Very erratic.

Date	Time	Hours Counted	Description
7/8	1240	0	Regenerator at 1840°F.
"	0700-2300		Fuel char transfer very erratic. Attempts to establish a balance period to no avail. Gasifier boot flow 25 percent steam, 75 percent recycle.
7/9	0700-1615		Fuel char transfer lining out. Started balance period. Without char feed for one hour due to sheared pin in lignite lock-hopper feeder below F-204A.
"	2200	33	Started feeding lignite.
7/10	0700		100 area (lignite grinding area) shut down due to plugging of Redler conveyor.
"	0745		100 area back in operation.
"	1205		Lignite feed lost due to malfunction of lockhopper differential pressure controller, dPC-2038.
"	1325		Steam to gasifier side decreased to conserve lignite.
"	1330		100 area down for repair of roller mill.
"	2032		Lost char transfer to regenerator.
"	2150		Methane used to maintain regenerator temperature. Having to fill lignite lockhopper with lignite out of tote bins. Trouble with 100 area grinding.
7/11	0300-0400	63	Out of lignite. Began feeding char to gasifier to build up bed level. 100 area trouble persisting. Chain on Redler conveyor broken.
"	1200	71	Feeding lignite again.
"	1500		Fuel char transfer nonexistent. 100 area operating again.
"	1620		Char transfer started but erratic.
"	2000		Char transfer improving.
7/12	0300	86	Fresh 6 X 9 dolomite addition started to regenerator.
"	0430		Acceptor transfer from regenerator erratic.
"	0700-1800		Acceptor transfer gradually improving. NOTE: The differential pressure between the reactors was lowered to improve the acceptor circulation.
7/13	1315		Increased steam flow to gasifier side.
"	1930	126.5	All air out of gasifier.
"	2010		Recycle removed from regenerator air flow.
"	2100		Air put back into gasifier.
"	2350		Air removed from gasifier.

Date	Time	Hours Counted	Description
7/14	0040		Circulation rate dropping off.
"	0130		Air back in gasifier. Air out of gasifier.
"	0415		Air in and out of gasifier.
"	0435		Air out of gasifier.
"	0700		Air in gasifier. Had problem with acceptor circulation so took steam out of boot.
"	0800		Steam back in boot.
"	1415		Circulation rate improving.
"	1540		Circulation momentarily lost due to system upset. NOTE: During last three days air was in and out of gasifier many times in order to control temperature during upsets.
"	2155	152.9	400 SCFH of CO_2 introduced to gasifier boot.
7/15	0430	159.5	Lignite feed to gasifier lost. Unable to feed from F-204A and unable to recharge F-204B.
"	0530		Char transfer stopped and methane added to regenerator to hold temperature.
"	0600		F-204B recharged and feeding to the system.
"	0630		Char transfer resumed. Methane combustion stopped.
"	0640		Lignite feed lost. NOTE: Line between lignite lockhoppers and gasifier plugged. Line was cleaned by removing spool piece under feeders.
"	0845		Lignite feed resumed.
"	1140		Lignite feed restricted. NOTE: Line cleared by blowing with 350 PSIG inert gas.
"	1355		CO_2 to gasifier boot increased to 540 SCFH.
"	1855		Flue gas added to preheater. Steam added to side of gasifier.
"	2155	176.9	Air removed from gasifier.
7/16	0530		Entire 100 area shut down due to Beta alarm panel malfunction.
"	0615		Transfer through TCV-2030 slowing.
"	0640	185.7	Air added to gasifier to maintain temperature.
"	0700	186	Beta panel again malfunctioned.
"	0725		Transfer through LCV-2003 erratic. NOTE: The valve shaft key worked loose. Key was welded in to secure.
"	0810		Acceptor transfer back to normal. Steam put back into boot.
"	1200	191	Lignite feed lost. Gasifier bed upset while trying to clear feed lines. Interface was lost.

Date	Time	Hours Counted	Description
7/16	1315		Dolomite makeup discontinued. Gasifier drained to spent acceptor lockhopper.
"	1330		Acceptor circulated during wait for char feed.
"	1512-1730		Lignite feed lines clear. Lignite replaced with char. Char feed started to gasifier. Interface established. Circulation started. Air introduced into gasifier.
"	1842		Dolomite makeup resumed at 300 LBS/HR.
"	2030		Char transfer started. CH_4 removed from regenerator.
"	2400	203	Expansion joint on gasifier side flow line, CO-203, leaking. Initiated shutdown procedures.
7/17	1100		System depressured.

3.2.2 Run 20

8/2	1355		Pressuring up system.
"	1515		Depressuring system due to a leak in the suction block valve bonnet on gasifier recycle compressor, J-201B.
"	1610		Pressuring up.
"	1900		Static pressure leak test started.
"	1940		Depressuring system due to a leak in expansion joint, EJ-5, on calcined acceptor standleg, CD-206.
8/3	1145		Pressuring up system.
"	1330		Depressuring system. Expansion joint, EJ-5, leaking.
8/6	1820		Pressuring up system.
"	2050		Depressuring system. Expansion joint, EJ-5, leaking.
8/8	1855		Pressuring up system.
"	2000		Recycle compressors started for line flow check.
"	2030		Compressors shut down--all lines seem clear.
"	2115		Static pressure leak tests started.
"	2200		Static pressure leak tests finished. Started recycle compressors and proceeded with gas circulation tests.
"	2225		Heaters lit.
"	2235-2350		Plug developed in lift line. Began depressuring procedures. Plug was cleared with system at 132 PSIG. System repressured.
8/9	0200		Began curing refractory.
"	1230		"A" zinc oxide tower shut down for turnaround.
"	2115		Refractory curing finished.

Date	Time	Hours Counted	Description
8/10	0230		Began steam tests to determine integrity of flow measurement.
"	1630		Steam tests completed. Steam and air removed from gasifier. "A" zinc oxide unit back in service.
"	1818		Began dead-burned dolomite addition to gasifier via lignite lockhopper, F-204A.
8/11	2030-0024		Acceptor transfer through gasifier boot level control valve, LCV-2003, very erratic, and line to acceptor dumphopper, F-213, plugged.
"	0740		Line to F-213 cleared.
"	0835-1235		Lift line, CD-208, plugged just below regenerator. Began depressuring system and plug was cleared.
"	1355		Began dead-burned dolomite feed to regenerator via makeup acceptor, F-206.
"	2355		Started solids circulation.
8/12	0025		Stopped solids circulation. Started lift line gas flow tests.
"	0435		Finished gas flow tests.
"	0500		Started solids circulation tests.
"	0715-0745		Circulation lost through LCV-2003. Regained circulation by blowing into S-10 sample station. NOTE: Five hot spots found on various lines.
"	1030		Circulation tests completed.
"	1255		Char addition started to gasifier.
"	1510		Started acceptor circulation. Introduced air to gasifier side.
"	1530		Began makeup dolomite addition via F-206.
"	1704		Started fuel char to regenerator.
"	1710		Introduced air to regenerator.
"	2015	0	Regenerator at 1800°F.
"	2030		Steam added to gasifier boot.
"	2400		Began cutting air and steam to gasifier side to raise temperatures.
8/13	0900	12.45	"B" zinc oxide tower taken out of service for turnaround.
"	1123		Lignite addition to gasifier started.
"	1850		Makeup hopper, F-206, filled with fresh 6 X 9 dolomite.
8/14	2025-0530		Char transfer through control valve, LCV-2002, very erratic. NOTE: Dolomite addition to regenerator stopped. Trouble experienced with feeding lignite to lockhoppers. Methane added to regenerator. Lignite feed replaced by char at 0440 hours.

Date	Time	Hours Counted	Description
8/14	0545		Char transfer reliable.
"	0600		Methane taken out of regenerator.
"	0645		Dolomite makeup started to regenerator.
"	0725		Char feed replaced with lignite.
"	0730-2000	47.45	Char transfer erratic at times.
"	2030		290 SCFH of CO_2 added to gasifier boot. All air taken out of gasifier side.
8/15	0800	59.45	Flue gas used to fluidize preheater.
"	1435		"B" zinc oxide tower put into service.
8/16	1145	87.30	Gasifier bed differential pressures dropped off rapidly. Lost fluidization.
"	1400		CO_2 removed from gasifier boot.
"	1510-1530		Steam removed from gasifier boot.
8/17	0125		Emptied gasifier of material. NOTE: All steam and air taken out of gasifier. Recycle compressors restarted. Zinc oxide unit taken off stream.
"	0230		Started dolomite circulation.
"	0340		Stopped circulation.
"	0400		Steam introduced into gasifier side.
8/17	0450		Began char feed to gasifier. Zinc oxide unit put back on line.
"	0739		Air introduced into gasifier side.
"	0800		Began acceptor circulation.
"	0830		Dead-burned dolomite fed to gasifier via F-204A.
"	0900-2000		Attempted to regain char-acceptor interface. Gasifier "tee" line, UAD-205, plugged.
"	2330		Began emptying gasifier.
8/18	0010		Air and methane taken out of regenerator.
"	0050		Air taken out of gasifier.
"	0430		Gasifier empty of materials.
"	0500		Gasifier "tee" finally cleared.
"	0505		Expanding regenerator bed with air.
"	0600		Steam taken out of gasifier side.
"	0630		Began increasing vessel temperatures.
"	0700		Attempted to transfer calcined acceptor to gasifier. Line plugged.
"	0945		Started shutdown procedures.
8/19	0600		System completely depressured.

3.2.3 Run 21

Date	Time	Hours Counted	Description
8/30	1520		Started pressuring up with air.
"	1605		System at 150 PSIG. Began static leak pressure test.
"	1850		Recycle compressors started.
"	1930		Heaters lit.
"	2130		Began refractory cure.
8/31	1530		Refractory cure completed. Began raising temperature at 100°F/HR.
9/1	0130		Started dead-burned dolomite addition to gasifier via lignite lockhopper, F-204A.
"	0530		Added air to regenerator.
"	1230		Started solids circulation.
"	1300		Stopped solids circulation.
			NOTE: Experienced high pressure from flue gas recycle compressors due to plugged sensing line.
"	1330		Began gas circulation tests.
"	1515		Lift line gas circulation tests finished.
"	1630		Started solids circulation tests.
"	1800		Solids circulation tests finished.
"	1810		Steam introduced to side of gasifier.
"	1900		Zinc oxide unit put in service.
"	1910		Air taken out of regenerator.
"	2105		Char addition to gasifier started.
			NOTE: Elliott test turbine put on line.
"	2230		Started solids circulation.
9/1	2350		Air introduced into gasifier side flow.
"	2400		Experienced 100 area shutdown when internal sleeve of the roller mill expansion joint, EJ-100, broke loose and cut dryer furnace control thermocouples.
9/2	0215		Started char transfer.
"	0213		Started air to regenerator.
"	0545		J-202 main air compressor experiencing trouble with second stage relief valve lifting.
"	0725		Air taken out of system. Char addition stopped.
"	0800		J-202 shut down for maintenance.
"	1225		J-202 repaired. Addition of air to system resumed.
"	1250		Char feed to gasifier resumed. Began char transfer to the regenerator.

Date	Time	Hours Counted	Description
9/2	1400		Steam added to gasifier boot flow.
"	1515	0	Regenerator at 1800°F.
"	1550		J-201B, gasifier recycle compressor, no longer needed--shut down.
"	2155		Began lignite addition to gasifier.
9/3	0230		Began easing air out of gasifier.
"	0630-1845		Experienced loss of char transfer to regenerator for short periods. Dolomite addition lost while a valve was repaired on F-206, dolomite makeup hopper.
"	1245	21.5	Fresh 6 X 9 dolomite started to system.
"	2130		Began removing air from gasifier again.
9/4	0030		Recycle gas removed from regenerator air ring.
"	0800		NOTE: Began procedures to conserve lignite due to loss of 100 area due to baghouse difficulty.
"	0845	41.5	All air removed from gasifier.
"	1805		Started flue gas to preheater.
"	2111		Lost char transfer.
"	2120		Regained char transfer.
"	2345		Sheared pin on L-204, dolomite makeup feeder. Open bypass and continued to feed while feeder was repaired.
9/5	0250		L-204, dolomite feeder, back in service. Bypass closed.
"	0335		Began CO_2 addition to gasifier boot.
"	1115		Raised steam to gasifier side to 30,000 SCFH.
"	1215	69	The "tube tester" was placed in service.
"	1400-1445		Without dolomite makeup while valve repaired between F-206 and F-206B. (Dolomite lock-hoppers).
9/6	1205		Pressure surge experienced on J-203 regenerator recycle compressor suction. NOTE: Pressure surge due to plug in regenerator overhead line breaking loose. Caused trouble with quench tower water outlet.
"	1450		Accidental ESD shutdown occurred. System upset but recovered.
9/7			NOTE: Attempted to increase dolomite circulation without success.
9/8	0300-0830		Slight system upset caused by regenerator quench tower. Flushed E-301 gasifier quench tower bottom and had upset in gasifier quench separators.

Date	Time	Hours Counted	Description
9/9			NOTE: Experienced regenerator quench trouble several times
9/10	1000		Found broken shaft on LCV-2002, char to regenerator control valve. Valve controlled by hand until actuator was welded on reverse side of shaft.
"	1400	190.75	LCV-2002 in service on manual control.
9/11	0700		Sulfur breakthrough on "A" zinc oxide tower.
"	0900		Lost gasifier quench tower water flow for a short time.
"	1145	212.5	Air introduced to side of gasifier to increase bed temperature.
9/12	0410		LCV-2002 in automatic control mode.
"	1600	240.75	"A" zinc oxide tower taken off stream.
9/13	0220	251	Dolomite transfer through CD-204 (carbonated acceptor from gasifier to engager pot transfer line) lost.
"	0240		Steam taken out of gasifier and replaced with recycle. Dumped contents of gasifier to spent acceptor lockhopper, F-213.
"	1700		Attempted to rid regenerator of excessive fines by increasing the velocity through the bed.
"	1920		Lost the seal on LCV-2003. Slumped regenerator bed and plugged lift line.
"	2100		Resumed dolomite circulation.
"	2200		Stopped dolomite circulation.
9/14	0040		Started steam to gasifier side.
"	0130		Started char addition to gasifier.
"	0205		Attempted to resume dolomite circulation.
"	0430		Steam removed from gasifier side.
"	0600		Recovered dolomite circulation.
"	0955		Stopped dolomite circulation.
"	1002		Resumed char feed to gasifier.
"	1135		Started dolomite makeup to regenerator.
"	1226		Introduced air to gasifier.
"	1230		Resumed dolomite circulation.
"	1425		Since performance of gasifier bed erratic, started shutdown procedures.
9/15	0630		System depressured and ready for maintenance.

4 RESULTS AND DISCUSSION

4.1 BACKGROUND

The major objective for Runs 19, 20, and 21 was to demonstrate long-term, integrated plant operation using lignite coal for the gasifier feedstock. Lignite from the Velva mine in North Dakota was used in each run. This coal was chosen for the low sodium content (about 2.5 weight percent Na_2O based on sulfur free ash) of its ash. Extremely high sodium coals with ash sodium contents greater than 14 weight percent were avoided. This was done since early bench-scale studies indicated that these coals promoted the formation of gasifier char bed deposits. However, to determine the process sodium tolerances in pilot plant equipment, coals with higher sodium levels will be tested at a later date.

Only slight modifications were made to the now standard startup procedure to incorporate the use of raw coal feed. The initial regenerator and gasifier inventories were dead-burned dolomite and Husky char respectively. The acceptor circulation was started and maintained at 4,000 to 6,000 LBS/HR while the char bed was established. Then the acceptor circulation was gradually increased to the normal operating rate of 11,000 LBS/HR.

After attaining process temperatures of 1840^{o}F in the regenerator and 1520^{o}F in the gasifier, the gasifier feedstock was switched to preheated raw lignite. At this stage of operation the regenerator temperature was maintained by burning fuel char from the gasifier. The gasification heat requirements were satisfied by circulating acceptor and by injecting air into the gasifier char bed. Sensible heat was derived from the temperature difference between the circulating acceptor and the gasifier char bed. The injection of air provided heat from the combustion of char.

After the plant operation became steady, the inactive dead-burned dolomite inventory was replaced. Fresh dolomite (nominally 6 X 9 Tyler mesh) was continually made up at a 600 LBS/HR rate while spent acceptor was continually withdrawn from the gasifier. As the activity increased, air was removed from the gasifier to maintain the char bed temperature. Finally, air injection was discontinued.

4.2 ACCOMPLISHMENTS

4.2.1 Major Achievements

The following summary lists the operational achievements for Runs 19, 20, and 21.

Summary of Plant Operations

Run	Hours: At Process Temperature	With Lignite Feed	With Fresh Acceptor Makeup	Without Gasifier Air
19	187	150	97	9
20	87	75	53	38
21	251	244	230	171

Clearly, these runs demonstrated the feasibility of the process using low sodium ash lignite coals for the gasifier feedstock. With each successive run, more hours were logged at the intended operating conditions without gasifier air addition. Essentially, all air was removed from the gasifier for 171 hours during Run 21. Of the 171 hours, air was totally removed for 120 hours. The discrepancy between the two times was due to the discovery of a small air leak through the closed block and control valves on the gasifier air line. The leak was then eliminated by triple blocking the line. Since the leak was small, only about 2,200 SCFH of air (equivalent to the burning of 15 LBS/HR of carbon to carbon dioxide), the official time is the higher value.

The run series also demonstrated that the gasifier conditions were severe enough to hydrocrack and react all the lignite volatile materials to hydrogen, methane, and carbon oxides. No condensable organic materials including such refractory compounds as benzene and napthalene survived the gasifier conditions. Ethane was the highest ranked hydrocarbon detected even for periods during Run 21 when the gasifier temperature dipped to 1460^{0}F. Typically, the concentration of ethane was less than 0.1 volume percent.

4.2.2 Run Data

Data obtained during the runs are presented tabularly at the end of this run report. Process conditions on a daily basis and during balance periods are shown in Tables 19-2 and 19-7. Physical and chemical property data for the process solids are summarized in Tables 19-8 through 19-25. The Run 19 feedstock compositions are reported for composited samples. Averaged values are used for the Run 20 and 21 analyses.

Typical complete elemental analyses for the feedstock are reported for Run 19 and have also been presented in previous reports. Much of the data contained in the complete elemental analyses is not

necessary for calculating heat and material balances or for understanding the process. Therefore, to help relieve the laboratory work load, many elemental analyses for Runs 20 and 21 were abbreviated with only the most important compounds listed.

Extensive balance period data were obtained during the three run series from which heat and material balances and the reaction kinetics can be calculated. Run 19 had three balance periods. The first two were base case periods for which the circulating acceptor had zero activity. Char was the gasifier feedstock for the first period (0700 to 1600 hours July 9, 1974) while preheated lignite was the feedstock for the second period (2000 hours July 11, 1974 to 0300 hours July 12, 1974). During the third period (2200 hours July 15, 1974 to 0600 hours July 16, 1974), there was no air injection to the gasifier and lignite was fed to the gasifier. For Run 20 one long, steady-state balance period (0700 hours August 15, 1974 to 0700 hours August 16, 1974) was obtained with lignite feedstock and no gasifier air. The three balance periods for Run 21 (first period, 1900 hours September 9, 1974 to 0300 hours September 10, 1974; second period, 2300 hours September 11, 1974 to 0500 hours September 12, 1974; and third period, 1900 hours September 12, 1974 to 0700 hours September 13, 1974) were all obtained after the acceptor activity had lined out at 0.30.

4.2.3 Leak Test

System integrity tests were often included in the plant startups. These tests included: (1) Leak checks; (2) gas flow measurement comparisons; and (3) a test to determine the acceptor circulation rate.

Static pressure leak tests were conducted for all three runs. The leak rate was determined by measuring the amount of inert gas required to maintain system pressure at 150 PSIG. For the cold system, the total inherent leak rate was between 4,000 to 4,500 SCFH. Leak rates were much higher when the system was at operating temperature. The estimated leak rate during Run 21 was 15,000 to 20,000 SCFH. Based upon the change in the gasifier vent, a large 'B' gas leak of 11,000 SCFH was discovered but not located when the 'B' gas dryers were taken out of service. Also, during Run 21 a 3,000 to 5,000 SCFH leak developed in the bonnet of the valve which blocks recycle gas from the gasifier side flow. Other primary leak sources are the gasifier and regenerator vent block valves, lockhopper vent valves, and various relief valves.

4.2.4 Vent Flow Tests

For the gas flow tests, comparisons were made between the measured air flows and the corresponding gasifier and regenerator vent rates. These tests were conducted only during Run 19. After applying

a reasonable leak rate (3,200 SCFH), the data showed that small corrections to the flow recorder readings were necessary to obtain a consistent set of data. Since the corrections were normally less than 2 percent of the transmitter range, the air and vent flow orifice readings were assumed to be correct.

4.2.5 Solids Circulation Tests

Acceptor circulation tests, which allow the solids circulation rate to be correlated as a function of the lift line pressure drop were performed during each run. Procedural details have been given in earlier run reports (i.e., Run 14 and 16). The data for Runs 20 and 21 agreed well with earlier data. However, the Run 19 data did not agree. A plot of the lift line pressure drop versus circulation rate for Run 19 shows that the slope is the same as that for the majority of data, but the intercept is higher. Since heat and material balances for the run indicate that the majority of data predict fairly well the acceptor circulation, the Run 19 data is probably in error.

The discrepancy may have been due to solids leakage through the gasifier boot level control valve, LCV-2003, during the circulation tests. The circulation rate was measured by the time required to fill the gasifier boot. Therefore, if any solids leaked past the valve, the filling time would be greater than expected, and the data would indicate less circulation for a given lift line pressure drop. The discovery near the end of the run that the shaft key for LCV-2003 had fallen out of the key way lends support to the leaking valve theory. Another possibility is that the lift line differential pressure transmitter zero may have shifted.

The circulation data for the three runs are not presented in this report. These data are being reevaluated with data from other runs to determine the best correlation.

4.2.6 Acceptor Activity

Air was removed as a source of heat from the gasifier during each run. This was made possible by changing out the inactive dead-burned dolomite with fresh active acceptor. Figure 19-1 shows the increase in acceptor activity with time towards the reaction of calcium oxide with carbon dioxide. At the 600 LBS/HR makeup rate, approximately 150 hours are required to substantially replace the original dead-burned dolomite. Only during Run 21 was total replacement achieved. For this run the final equilibrium acceptor activity was 0.30.

The cause of the apparent activity plateau of 0.23, which was reached after about 70 hours of fresh acceptor makeup during Run 19,

is not known. However, research is now being conducted by Conoco Coal Development Company in Library, Pennsylvania, to better determine the effects of process conditions on acceptor activity.

4.2.7 Temperature Profiles

Figures 19-2 and 19-3 show temperature profiles for the gasifier and regenerator during Run 21. The data shown should be considered as typical of the fluid bed conditions since similar data were obtained for all three runs. Two periods of operation are shown in the figures. For both periods lignite was the gasifier feedstock. During the early period, inactive dead-burned dolomite made up the circulating acceptor inventory while during the second period active acceptor was circulated. In the gasifier the low transition section temperature was the result of mixing the relatively cold lignite feed (300° to 450°F) with the gasifier char bed. However, the small temperature gradient for the bulk of the char bed indicates that the effect of the cold feed was dissipated rapidly by backmixing.

A small amount of carbon dioxide (400 to 625 SCFH) was injected into the boot fluidizing gases when steam was used to replace part of the recycle gas. This was done to keep the spent acceptor from calcining and possibly forming agglomerates in the gasifier boot due to low CO_2 partial pressure. The high boot temperature during the second period shown in Figure 19-2 suggests that the showered acceptor was not completely recarbonated when it entered the boot. Therefore, the high boot temperature may result from the exothermic reaction between the acceptor and the CO_2.

As shown in Figure 19-3, the regenerator thermal gradients were small when the calcining duty was minimal (first condition). For the second condition, the large heat sinks provided by the circulating active acceptor and the fresh makeup significantly dropped the regenerator bottom temperature. Again due to rapid backmixing, only a small thermal gradient normally existed in the bulk of the acceptor bed.

4.2.8 Pressure Balance

The system pressure balance relationships are given in Table 19-1 at various times during the three runs. Figure 19-4 shows the locations of the fourteen pressure points listed in Table 19-1. At all times the standleg purges above the butterfly control valves were controlled to provide seals against regenerator gases leaking into the gasifier.

4.2.9 Heater Corrosion

During Run 17, a form of corrosion, referred to as metal dusting, was found to be occurring in the gasifier boot recycle gas heaters. Metal carburization was the apparent cause of the corrosion. To eliminate the problem, steam was injected into the gasifier recycle gas.

The steam represented 30 to 60 percent of the total flow when the heaters were operated at 1500°F. Based upon ultrasonic thickness measurements made after each run, the heater tube corrosion was eliminated. The steam controls the corrosion in two ways. First, it provides a protective oxide film on the inside of the heater tubes. Secondly, it adjusts the gas composition so that the following carbon deposition reactions do not occur:

$$2CO \longrightarrow CO_2 + C$$

$$CH_4 \longrightarrow 2H_2 + C$$

4.3 PROBLEMS

4.3.1 Intermediate Fines

A new process problem was recognized during Run 21 which had gone undetected in previous runs. Throughout the run, fines (non-char/non-acceptor material) accumulated in the gasifier char bed. Eventually, the fines increased to a level which destroyed the operating stability of the transition section and caused the plant to be shut down.

The accumulated fines were predominantly -28 by +65 Tyler mesh material which had a density of 135 LBS/CU FT. With the present plant configuration, material of this size range and density is trapped within the system. The regenerator velocity is not sufficient to strip particles larger than 65 mesh. Particles smaller than 28 mesh cannot be purged from the gasifier with the rejected spent acceptor. Therefore, the intermediate fines material can only circulate through the fuel char line to the regenerator, back to the gasifier with the calcined acceptor, and accumulate in the char bed. Although the accumulation rate was low (about four pounds per hour), the level at the end of Run 21 was 27 percent of the char bed.

The fines were derived from mineral constituents, particularly quartz sand, in the lignite feed. Upon microscopic examination, many of the fines were revealed to be a sand particle surrounded by adhering acceptor fines.

In a commercial operation, the intermediate fines would pose no problem. For example, part of the gasifier char bed could be periodically or continuously withdrawn, ground to -100 mesh, and used as regenerator fuel. A char removal system is now being built for the pilot plant. This will allow plant operation for longer periods than that achieved for Run 21.

The intermediate fines buildup was monitored by a recently developed technique for determining the percent acceptor in samples of the gasifier char bed and the regenerator fuel char. The procedure

involved burning a 20 gram sample in a muffle furnace and then screening the residue through an 80 U.S. standard mesh screen. Since the char ash is friable and passes through the screen, the +80 mesh fraction represents non-char materials. For determining the percent acceptor, the new technique does have limitations. Results are influenced by the amount of adhering char ash, percent intermediate fines material, and the acceptor activity for which correction is usually not made. However, the analysis does approximate the percent acceptor in the mixtures and trends can be easily determined.

The fuel char analyses reported for the three runs were obtained using the new technique. To obtain accurate data, samples are tediously hand separated at Conoco Coal Development Company's Research Center in Library, Pennsylvania. Since the separations are time-consuming, usually taking a week or longer to perform, only a very few representative samples for specific balance periods are analyzed.

4.3.2 Deposits

During all three runs, deposits, which were principally agglomerated dead-burned dolomite, formed in the gasifier boot. The amount of this material varied from 50 to 80 pounds, depending upon the run. (See Tables 19-26 and 19-27 for compositions). The presence of the dead-burned dolomite indicates that the deposits were formed early in the runs. The buildups apparently did not affect the operation of the boot until a major process upset occurred which in some way changed the boot gas distribution.

Examination of the deposits showed that the individual particles were cemented together at points of contact. In order to obtain a quick estimate of what the "cement" or "glue" was, part of the Run 21 deposit was crumbled and screened. As shown in Table 19-27, the fines fractions which should contain higher percentages of the "glue" material were high in silica. Therefore, the "glue" may be ash derived.

There is also evidence that poor gas distribution played a part in the formation of the deposits. The largest buildups were always behind the recarbonated acceptor outlet line, CD-204. This is an area which is somewhat shielded from gas flow by the protruding pipe. Modifications to the boot gas distributor are being considered as a means of eliminating the deposits.

During Run 20 a large deposit of agglomerated acceptor and char ash formed in the gasifier transition section. This deposit resulted from the unusual conditions of the Run 20 shutdown. When the cyclone dipleg fell into the gasifier boot, the char bed defluidized. Then in order to hold the char bed temperature, a small amount of air was

momentarily admitted to the gasifier. The air was quickly removed when the transition temperature increased from about 1500° to 1945°F. The high temperature probably resulted in ash slagging which agglomerated the acceptor in the transition section. Significantly, no transition zone deposits were found after the end of the much longer Run 21.

Only minor deposits were found in the regenerator following each run. A small amount of dead-burned dolomite agglomerated in a dead area below the air distributor forming a steeper cone in the bottom vessel head. Also, a small deposit of fused char ash and acceptor formed during each run below the char inlet line. Neither deposit adversely affected the operations.

4.3.3 Fuel Char Transfer

At times during all three runs, the regenerator fuel char transfer could not be reliably maintained. Most losses occurred early in the runs when the char transfer was first being established. As the runs progressed, the fuel char feed became stable. The transfer losses were apparently due to the pressure balance on the char standleg, CO-202. This pressure balance affects the amount of gas flowing through the standleg against the direction of the char flow. As little as 10 SCFH gas flow will fluidize and strip the char from the char-acceptor mixture. Therefore, solids bridging and the formation of gas pockets can easily occur in the line.

Standleg stability was maintained during Run 19 by supplying a small purge at the upper end of the line. This apparently stripped some fine char from the fuel char-acceptor mixture as the material entered the line. By increasing the coarseness of the standleg material, the solids bridging and gas bubble formation were eliminated. During Runs 20 and 21 the char transfer became erratic after the gasifier char bed density dropped due to the use of lignite feedstock. Dependable transfer was maintained after system pressure upsets were eliminated during Run 20. For Run 21, the transfer was regained by blowing solids out of the standleg with purge gas and then allowing the line to refill. The line was cleared between the S13A (third floor) sample station and the gasifier.

4.3.4 Acceptor Circulation

The rate at which calcined acceptor could be transferred from the regenerator to the gasifier decreased as each run progressed. This became a severe handicap during Run 21 since the circulation rate was only sufficient to maintain the gasifier char bed temperature at 1480°F. Differential pressure measurements indicated that the acceptor transfer through the 4-inch standleg, CD-206, was governed by the rate at which solids could enter the line. Circulation may be limited

due to the presence of a bend in the upper section of the line. This bend was caused by either sagging of the line in the regenerator refractory or by thermal expansion of the line against the refractory in previous runs.

However, calculations based upon laboratory data for solids circulation through a 3-inch ID 60 degree sloped line indicate that the line is being operated near capacity. This is due to the increased number of cubic feet of material which must be circulated as the dense dead-burned inventory is changed out with fresh acceptor. Plans are to replace the 4-inch line with a 6-inch line.

4.3.5 Expansion Joints

The three run series was marked by failures of the external pressure jacket expansion joints on several of the double walled hot lines. The 304 SS expansion joints on the recarbonated acceptor standleg, CD-204, and the gasifier side flow line, CO-203, developed leaks during Run 19. The CD-204 expansion joint was replaced with an identical unit from the gasifier system, and a new 304 SS expansion joint was installed in the CO-203 line.

During Run 20 the expansion joint on the calcined acceptor standleg, CD-206, failed and was replaced with a new joint made of Incoloy 825. The metallurgy was changed since metallographic examinations showed that the previous failures resulted from chloride attack and stress cracking. As a precaution against further failures, spare expansion joints of solution annealed Incoloy 825 alloy have been ordered for all critical lines.

4.3.6 Slip Joints

In Run 16 severe erosion of the two acceptor lift line slip joints occurred. To improve the service life, several abrasion resistant materials have been used to line the cone shaped slip joints. The materials tested to date include: Chrome carbide; nickel aluminide; and Stellite 12. Both the chrome carbide and the nickel aluminide are flame sprayed materials while the stellite is weld overlayed on to the cone surface. The stellite coated slip joints were the most satisfactory. Inspection of the lower slip joint showed negligible erosion had taken place between Runs 17C and 19. Following Run 21 both slip joints were inspected. Small areas on both slip joints had eroded and were weld overlayed. Since the erosion rate is highly sensitive to the lift gas velocity, most of the erosion probably occurred near the end of Run 21. To elutriate fines from the regenerator bed, acceptor was circulated and the lift gas rate was increased from 53,000 SCFH to 97,000 SCFH (50 FT/SEC to 91 FT/SEC).

As a safety precaution the double walled lines which carry hot solids are painted with a heat sensitive material. This allows the detection of possible erosion damage to the internal liner. Should erosion occur, gas bypassing and thinning of the insulation around the inner liner would cause visible discolored areas on the outside pressure containing pipe. During all three runs, hot spots developed on various lines. Insulation voids were responsible for all the Run 19 hot spots. The location of these were: (1) On the fuel char standleg, CD-202 (third floor); (2) on the acceptor lift line, CD-208 (fourth floor); and (3) on the calcined acceptor standleg, CD-206 (sixth floor). During Run 20 insulation voids again caused hot spots on the acceptor lift line (third floor) and on the gasifier side flow line, CO-203 (below XCV-2013). Other hot spot causes were: inadequate insulation in the cone end plate area of the gasifier tee, UAD-205; and failure of end plates on both the acceptor lift line (below flange with XCV-2010, and the calcined acceptor return line, CD-204 (at flange with LCV-2003). Again during Run 21, insulation voids caused hot spots on the acceptor lift line (at flange below XCV-2010) and on the fuel char lift line, CO-204 (just below sixth floor). None of the hot spots posed a threat to the operation of the plant.

4.3.7 Lignite Scalping Screen

The operation of the lignite scalping screen which separates ground lignite into fines, oversize and product was not reliable during Run 19. Steam backflushing from the preheater caused plugs in the fines and oversize lines. To eliminate the steam backflushing, a second star feeder was installed in series with the existing feeder between the preheater and the screen, and the space between the two feeders was purged. Since these modifications provided a seal against the preheater steam, the scalping screen operation became almost trouble free during the following Runs 20 and 21.

5 FUTURE PLANS

Because of the fines accumulation problem, a char removal system will have to be installed if runs of long duration are to be attempted. Therefore, a limited objective run will be made to determine: (1) the feasibility of using 100 percent steam as the gasifier boot fluidizing medium; and (2) the effect of the steam on acceptor activity. Following this run the plant will be shut down for an extended turnaround. The turnaround will include the installation of a gasifier char removal system, replacement of the regenerator refractory, modifications to the gasifier quench system, and installation of tie-ins between the new methanation facilities and the present plant.

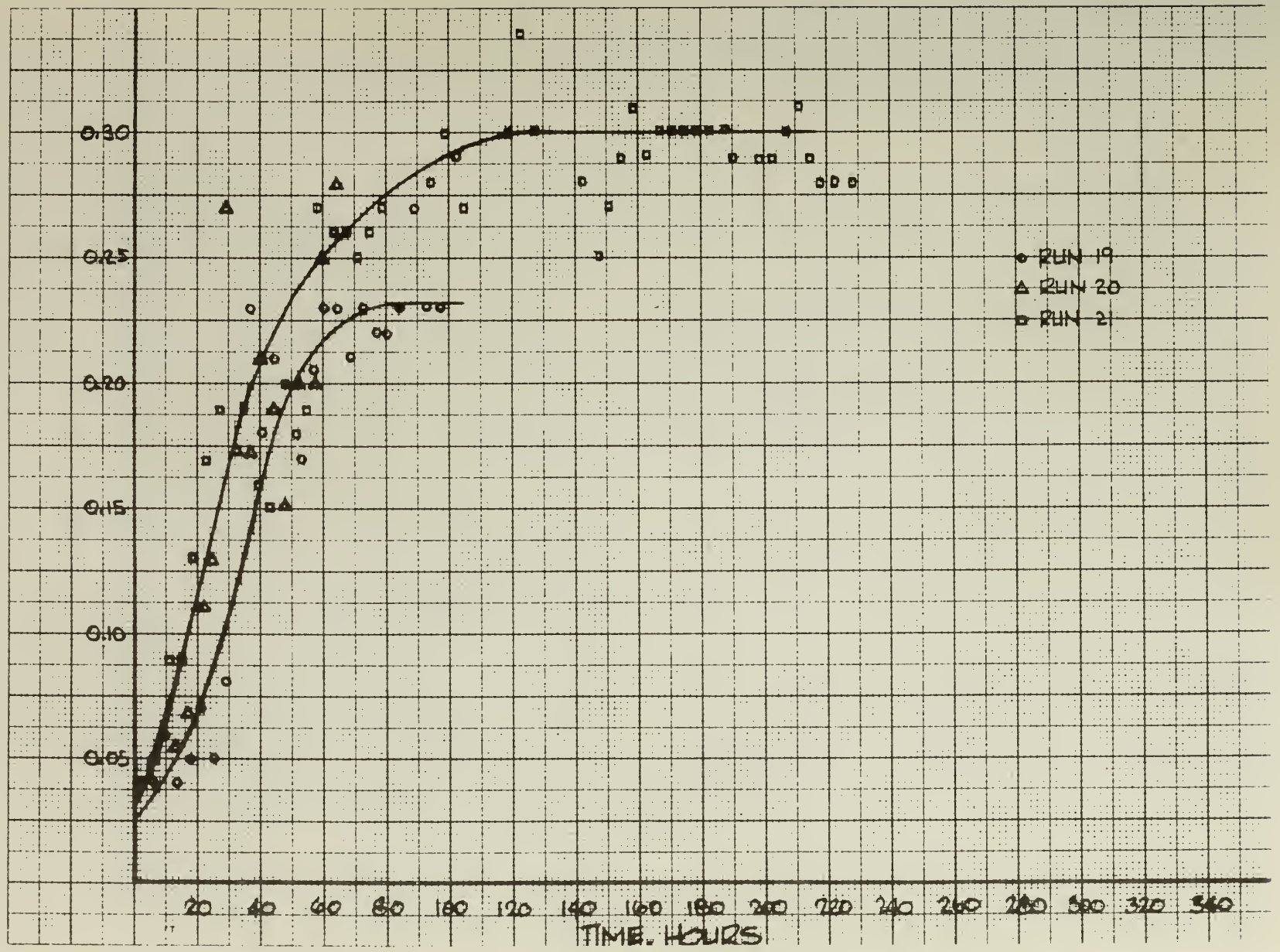


Figure 19-1. ACCEPTOR ACTIVITY AS A FUNCTION OF TIME

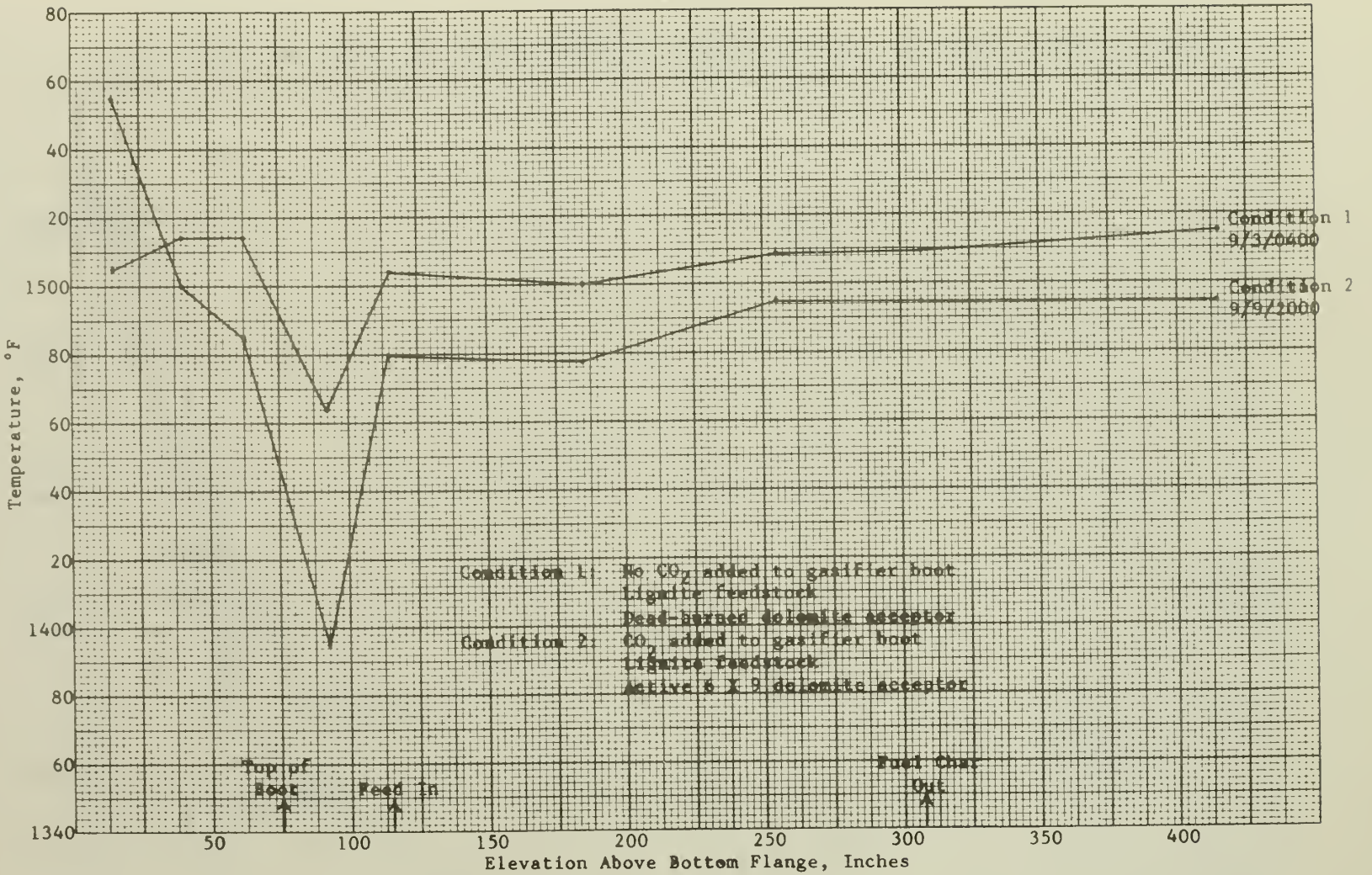


Figure 19-2. TYPICAL GASIFIER TEMPERATURE PROFILE, RUN 21

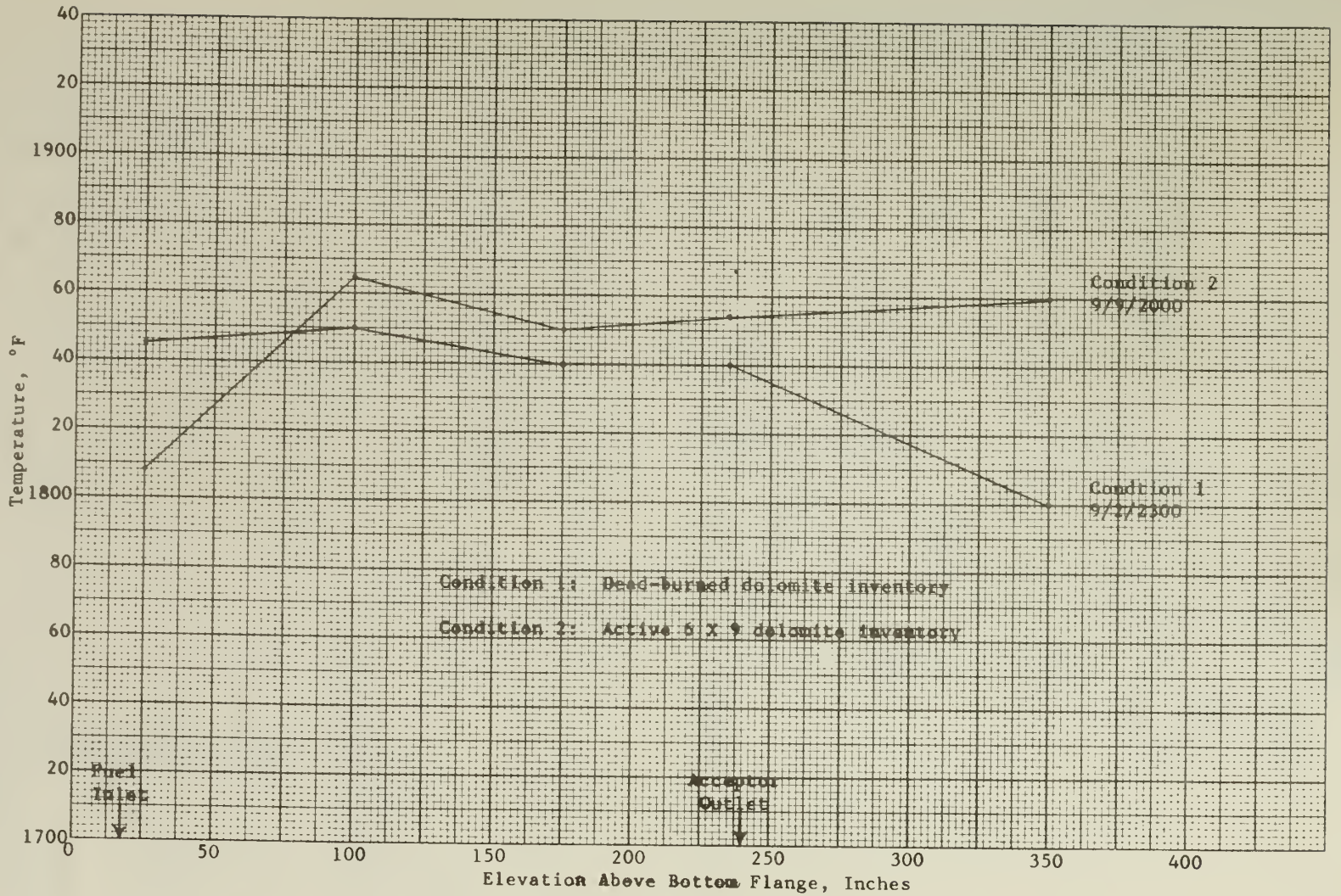
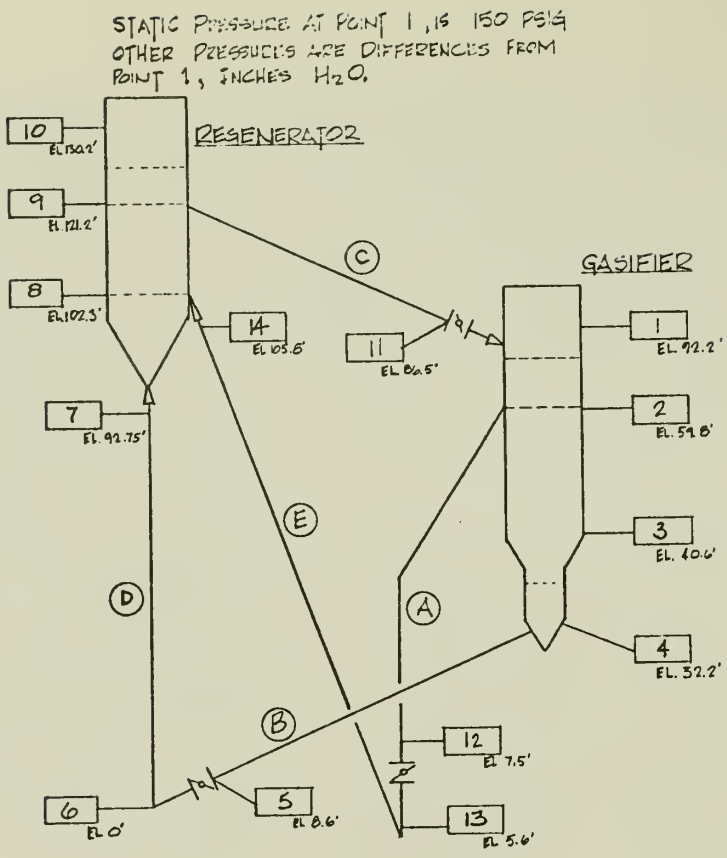


Figure 19-3. TYPICAL REGENERATOR TEMPERATURE PROFILE, RUN 21



PHYSICAL PARAMETERS

	Reference Point Numbers	I.D., Inches
Standlegs		
A (Fuel Char)	12-2	3
B (Recarbonated Acceptor)	5-4	4
C (Calcined Acceptor)	11-9	4
Solids Flow Control Valves		
Fuel Char	12-13	2
Recarbonated Acceptor	5-6	4
Calcined Acceptor	11-1	4
Lift Lines		
D (Recarbonated Acceptor)	6-7	4
E (Fuel Char)	13-14	2

Figure 19-4. PRESSURE BALANCE DIAGRAM, RUN 21

Run		19			19			19			20	
Date		7/9			7/11			7/16			8/15	
Pressure Location	Reference Point	DP In H_2O		P* In H_2O	DP In H_2O		P* In H_2O	DP In H_2O		P* In H_2O	DP In H_2O		P* In H_2O
1				0			0			0.0			0.0
2	1	70.8		70.8	66.6		66.6	57.6		57.6	53.5		53.5
3	2	136.9		207.7	123.4		190.0	120.7		178.3	111.9		165.4
4	3	97.2		304.9	91.8		281.8	83.3		261.6	82.6		248.0
5	4	65.0	(65.2)	369.9	-12.6	(-12.6)	269.2	15.0	(19.2)	276.6	35.0	(38.8)	283.0
6	5	3.0		372.9	-0.4		268.8	-2.0		274.6	-8.0		275.0
7	6	53.9		319.0	58.1		210.7	42.9		231.7	55.4		219.6
8	7	70.3		248.7	71.8		138.9	49.3		182.4	55.3		164.3
9	8	340.7		-92.0	361.5		222.6	248.3		-65.9	258.0		-93.7
10	9	20.0		-112.0	51.6		-274.2	30.1		-96.0	24.3		-118.0
11	9	102.0	(112.7)	10.0	232.6	(234)	10.0	76.7	(83.5)	10.8	97.7	(101.0)	4.0
1	11	-10.0		0.0	-10.0		0.0	-10.8		0.0	-4.0		0.0
12	2	235.6	(206.9)	306.3	139.2	(121.7)	205.8	198.7	(187.1)	256.4	174.0	(182.0)	227.6
13	12	-35.0		271.3	-37.5		168.3	-35.0		221.4	-32.5		195.1
14	13	21.5		149.8	27.8		140.5	37.4		184.0	29.1		166.0
8	14	1.1		248.7	1.6		138.9	1.6		182.4	1.8		164.2

*Pressure above base pressure of 150 psig.
( )Actual measured dP.

Table 19-1. PRESSURE BALANCE FOR REGENERATOR--GASIFIER SYSTEM (Sheet 1 of 2)

Run		21			21			21	
Date		9/9			9/11			9/12	
Pressure Location	Reference Point	DP In H_2O		P* In H_2O	DP In H_2O		P* In H_2O	DP In H_2O		P* In H_2O
1				0.0			0.0			0.0
2	1	60.3		60.3	60.7		60.7	66.8		66.8
3	2	125.0		185.3	136.9		197.6	131.5		198.3
4	3	80.0		265.3	83.7		281.3	85.1		283.4
5	4	55.2	(55.2)	320.5	34.0	(31.3)	315.3	35.0	(46.7)	318.4
6	5	-8.0		312.5	-4.0		311.3	-4.0		314.4
7	6	48.9		263.6	44.3		267.0	44.8		269.6
8	7	49.4		214.2	51.0		216.0	50.9		218.7
9	8	253.8		-39.6	253.9		-37.9	262.6		-43.9
10	9	27.3		-67.0	27.4		-65.3	33.1		-77.0
11	9	39.6	(32.3)	0.0	37.9	(38.2)	0.0	43.9	(55.3)	0.0
1	11	0.0		0.0	0.0		0.0	0.0		0.0
12	2	221.3	(232.5)	281.6	230.6	(250.0)	291.3	231.9	(258.0)	298.7
13	12	-22.5		259.1	-22.5		268.8	-30.0		268.7
14	13	42.9		216.2	50.6		218.2	48.1		220.6
8	14	2.0		214.2	2.2		216.0	1.9		218.7

*Pressure above base pressure of 150 psig.
( )Actual measured dP.

Table 19-1. PRESSURE BALANCE FOR REGENERATOR--GASIFIER SYSTEM (Sheet 2 of 2)

Date	7/8	7/8	7/8	7/9	7/9	7/9	7/9	7/10	7/10	7/11	7/11	7/12	7/12	7/12	7/12
Time	0900	1500	2300	0700	1100	1500	2300	0710	1500	1100	2300	0300	0700	1500	2300
Jacket Steam Make, lb/hr	←							0							→
Solids															
Feedstock	←		Char	→		←	Lignite	→		Char		←	Lignite		→
Feed Rate, lb/hr(1)	500	500	1,360	1,360	1,150	500	1,900	2,000	2,150	1,650	2,900	2,500	2,500	2,350	2,275
Heating Value, Btu/lb	←		12,060	→		←	11,124	→		12,060		←	11,124		→
Dump Acceptor, lb/hr	420	520	275	520	500	250	250	370	370	460	980	500	520	600	240
Gas Flow(2)															
Boot (Recycle), SCFH	30,800	18,100	20,100	19,500	17,200	15,600	15,600	16,300	14,600	11,600	11,200	12,800	14,900	13,700	16,000
Boot (Steam), SCFH	0	13,500	13,500	11,800	11,700	15,100	15,100	14,660	15,700	16,600	16,960	16,700	16,650	16,300	16,500
Steam to Side, SCFH	20,800	25,400	17,400	21,800	20,400	20,500	22,700	25,800	23,950	18,000	16,200	22,000	17,800	19,500	19,400
Air to Side, SCFH	19,000	23,000	12,600	9,700	13,600	13,400	23,900	22,000	20,200	15,600	23,800	22,400	15,800	11,300	10,400
Purges															
Recycle, SCFH	3,990	4,080	4,300	4,400	4,400	4,280	4,250	4,270	4,200	4,200	4,250	4,400	4,430	4,550	4,920
Inert, SCFH	←							400							→
Total Flow In, SCFH	75,000	84,400	68,300	67,600	67,700	69,200	81,900	83,400	79,100	66,500	72,900	78,700	69,800	65,800	67,600
Vent Rate, SCFH	28,300	40,900	31,000	27,000	34,800	37,900	61,300	61,200	58,500	44,000	64,500	60,400	42,000	45,200	45,200
Bed Conditions															
Boot Velocity, ft/sec	1.61	1.67	1.77	1.65	1.53	1.63	1.57	1.66	1.62	1.48	1.50	1.58	1.69	1.60	1.80
Char Bed Velocity Inlet, ft/sec	0.79	0.86	0.67	0.66	0.68	0.69	0.84	0.85	0.80	0.66	0.73	0.81	0.70	0.65	0.66
Boot Density, lb/ft3(3)	111	107	102	103	101	102	104	101	104	101	104	99	102	98	92
Char Bed Density, lb/ft3(3)	46	41	44	44	40	43	41	41	40	45	39	40	42	37	35
Boot Temperature, °F	1390	1495	1490	1527	1515	1513	1420	1525	1525	1490	1515	1527	1523	1510	1595
Char Bed Temperature, °F	1429	1508	1493	1532	1519	1522	1523	1527	1524	1498	1510	1531	1518	1502	1513
Overhead Gas Composition, Mol %															
O_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	13.3	19.4	18.0	20.9	18.9	19.6	20.1	18.4	21.3	18.7	20.7	20.9	18.8	14.8	16.5
CO_2	13.9	12.2	13.6	14.0	15.6	14.6	13.4	13.7	14.4	12.4	12.3	12.9	11.2	10.3	8.1
N_2	48.6	41.2	29.2	23.0	26.8	28.4	31.1	30.3	29.4	36.1	30.8	30.9	26.9	28.7	18.6
H_2	21.1	24.4	34.9	38.0	34.8	33.4	30.9	32.3	28.3	28.6	29.5	29.1	35.3	38.7	46.8
CH_4	3.1	2.8	4.3	4.1	3.9	4.0	4.5	5.3	6.5	4.2	6.7	6.2	7.8	7.5	10.0
H_2O Mol Fraction	11.8	11.0	19.6	20.7	20.0			20.8							

(1) Calculated by feeder RPM
(2) Determined by orifice flow meter measurements
(3) Density indicated by pressure tap readings

Table 19-2. GASIFIER DATA, RUN 19 (Sheet 1 of 2)

Date	7/13	7/13	7/13	7/14	7/14	7/14	7/15	7/15	7/15	7/16	7/16	7/16
Time	0700	1500	2300	0300	1500	2300	0300	1500	2300	0300	0700	2300
Jacket Steam Make, lb/hr	←						0					→
Solids												Char
Feedstock	←					Lignite						
Feed Rate, lb/hr[1]	1,660	2,120	1,660	2,070	1,920	1,920	2,170	2,720	1,710	2,070	2,170	1,920
Heating Value, Btu/lb	←					11,124					→	12,061
Dump Acceptor, lb/hr	240	290	350	350	390	400	320	312	192	192	190	100
Gas Flow[2]												
Boot (Recycle), SCFH	16,500	15,000	15,900	16,700	15,100	16,400	13,700	13,900	15,800	17,500	15,200	19,800
Boot (Steam), SCFH	16,800	16,700	17,300	16,300	18,400	17,200	17,700	16,300	17,700	17,300	17,200	10,400
Steam to Side, SCFH	20,300	21,300	22,200	22,700	27,400	27,100	26,000	27,600	31,000	31,200	30,700	29,700
Air to Side, SCFH	7,980	7,870	5,600	6,230	0	6,800	6,140	6,890	0	0	6,180	8,690
Purges												
Recycle, SCFH	5,080	5,080	5,520	5,520	5,260	5,460	4,970	5,080	5,610	5,610	5,460	4,480
Inert, SCFH	←					400						→
Total Flow In, SCFH	67,000	66,300	66,500	67,900	66,700	73,400	69,000	70,200	70,500	71,900	75,100	73,500
Vent Rate, SCFH	35,700	39,700	33,000	31,400	30,600	36,400	32,700	41,000	59,510	66,960	76,790	70,000
Bed Conditions												
Boot Velocity, ft/sec	1.84	1.76	1.82	1.83	1.79	1.84	1.74	1.66	1.80	1.86	1.73	1.64
Char Bed Velocity Inlet, ft/sec	0.67	0.65	0.66	0.67	0.65	0.72	0.68	0.69	0.69	0.70	0.74	0.71
Boot Density, lb/ft^3[3]	92	90	87	87	81	86	84	86	86	86	86	83
Char Bed Density, lb/ft^3[3]	34	34	36	36	35	35	34	37	36	37	37	40
Boot Temperature, °F	1580	1590	1560	1582	1515	1570	1585	1575	1540	1536	1560	1550
Char Bed Temperature, °F	1527	1523	1520	1510	1506	1511	1508	1505	1501	1504	1507	1496
Overhead Gas Composition, Mol %												
O_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	15.8	16.0	13.3	13.9	14.2	13.1	13.6	13.6	12.2	12.0	12.2	15.7
CO_2	8.1	8.4	7.1	6.9	6.6	8.2	9.8	8.3	7.8	7.2	7.6	10.4
N_2	15.9	14.5	11.0	9.7	16.1	11.3	15.9	14.6	8.0	6.8	12.2	32.0
H_2	50.2	50.0	56.3	57.6	51.3	55.8	47.0	50.6	59.2	59.9	55.4	37.1
CH_4	10.0	11.1	12.3	11.9	11.8	11.6	13.7	12.9	12.8	14.1	12.6	4.8
H_2O Mol Fraction						33.7	35.0					

(1) Calculated by feeder RPM
(2) Determined by orifice flow meter measurements
(3) Density indicated by pressure tap readings

Table 19-2. GASIFIER DATA, RUN 19 (Sheet 2 of 2)

Date	7/8	7/8	7/8	7/9	7/9	7/9	7/9	7/10	7/10	7/11	7/11	7/12	7/12	7/12	7/12
Time	0900	1500	2300	0700	1100	1500	2300	0710	1500	1100	2300	0300	0700	1500	2300
Jacket Steam Make, lb/hr	320	310	360	360	360	380	370	370	380	370	380	370	370	380	380
Solids															
Acceptor Feedstock	← Dead-Burned Dolomite →											← 6 X 9 Dolomite →			
Acceptor Makeup, lb/hr	300	225	450	225	225	225	225	300	300	375	450	← 600 →			
Acceptor Circulation, lb/hr(1)	6,000	5,200	11,000	15,000	12,200	14,000	12,200	14,000	15,000	13,100	15,600	18,000	15,200	15,000	13,000
Ash & Attrited Acceptor, lb/hr(2)	50	50	50	80	80	65	90	90	50	50	90	100	140	50	70
Gas Flows(3)															
Acceptor Lift, SCFH	56,700	56,300	56,500	57,500	56,500	56,600	56,600	56,700	56,500	56,400	56,500	53,200	56,600	52,300	50,800
Char Lift, SCFH	7,160	7,140	7,090	7,090	7,200	7,150	7,180	7,180	7,160	7,000	7,230	7,200	7,000	6,980	7,200
Air Line															
Recycle, SCFH	71,500	42,500	35,400	36,000	37,400	31,200	20,800	21,400	20,800	19,800	17,700	10,000	15,400	14,400	14,800
Air, SCFH	27,000	40,800	51,500	56,200	48,000	52,000	46,800	46,800	51,500	44,400	53,800	53,000	62,300	70,700	66,700
Purges															
Recycle, SCFH	410	420	420	430	430	430	430	430	430	420	430	420	420	430	420
Inert, SCFH	←							1,530	→						
Nitrogen, SCFH	←							850	→						
Total Flow In, SCFH	165,000	149,000	153,000	159,000	151,900	150,000	134,000	135,000	138,000	130,000	139,000	126,200	144,000	147,000	142,000
Vent Rate, SCFH	35,400	52,200	60,000	62,600	56,300	61,800	54,050	56,250	55,000	56,700	65,900	63,600	79,700	94,500	86,400
Bed Conditions															
Gas Velocity Inlet, ft/sec	2.38	2.74	2.82	2.92	2.76	2.74	2.46	2.45	2.54	2.35	2.51	2.30	2.53	2.70	2.62
Bed Density, lb/ft^3(4)	113	116	112	114	114	108	114	114	117	115	117	113	118	112	103
Average Bed Temperature, °F	1349	1842	1850	1837	1830	1840	1850	1827	1848	1814	1834	1842	1834	1853	1859
Overhead Gas Analysis, Mol %															
O_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	0.95	3.4	1.8	2.2	2.2	4.1	2.0	2.8	2.6	0.6	3.8	3.4	2.9	1.6	3.2
CO_2	16.4	16.8	16.8	10.3	17.2	16.4	16.8	17.2	17.8	18.0	16.8	18.0	21.6	24.0	22.4
N_2	82.6	79.8	81.4	87.5	80.6	79.5	81.2	80.0	79.6	81.4	79.4	78.6	75.5	74.0	74.4

(1)
(2) Determined by lift line pressure drop measurements
(3) Determined by weigh scale measurements
(4) Determined by orifice flow meter measurements
Density indicated by pressure tap readings

Table 19-3. REGENERATOR DATA, RUN 19 (Sheet 1 of 2)

Date	7/13	7/13	7/13	7/14	7/14	7/14	7/15	7/15	7/15	7/16	7/16	7/16
Time	0700	1500	2300	0300	1500	2300	0300	1500	2300	0300	0700	2300
Jacket Steam Make, lb/hr	360	370	350	350	350	350	330	320	320	300	310	380
Solids	← 6 X 9 Dolomite →											
Acceptor Feedstock												
Acceptor Makeup, lb/hr	600	600	600	600	600	600	600	600	600	600	600	600
Acceptor Circulation, lb/hr(1)	12,700	12,000	12,600	11,400	11,800	10,400	10,200	10,800	10,800	11,200	9,800	6,200
Ash & Attrited Acceptor, lb/hr(2)	75	120	100	100	75	70	60	100	100	100	100	50
Gas Flows(3)												
Acceptor Lift, SCFH	51,000	50,500	50,800	50,600	51,000	51,200	56,900	51,200	51,000	51,100	51,000	54,100
Char Lift, SCFH	7,080	7,050	7,000	7,200	7,200	7,300	7,330	6,600	6,780	6,800	6,800	6,800
Air Line												
Recycle, SCFH	12,300	12,600	0	0	0	0	0	0	0	0	0	0
Air, SCFH	63,400	67,600	63,800	63,500	72,800	62,600	62,200	65,500	63,800	65,400	64,500	55,000
Purges												
Recycle, SCFH	← 420 →											
Inert, SCFH	← 1,530 →											
Nitrogen, SCFH	← 850 →											
Total Flow In, SCFH	136,000	140,000	124,000	124,000	134,000	124,000	129,000	126,000	124,000	126,000	125,000	119,000
Vent Rate, SCFH	86,600	88,000	84,900	84,500	98,500	82,700	86,000	91,600	85,000	90,400	86,100	75,200
Bed Conditions												
Gas Velocity Inlet, ft/sec	2.49	2.59	2.27	2.27	2.46	2.26	2.35	2.31	2.27	2.31	2.31	2.18
Bed Density, lb/ft3(4)	98	93	89	90	90	83	88	86	85	84	87	81
Average Bed Temperature, °F	1838	1865	1845	1848	1859	1844	1840	1848	1847	1850	1865	1869
Overhead Gas Analysis, Mol %												
O_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	2.3	1.2	3.2	2.2	2.6	2.9	2.6	3.2	1.5	2.7	2.2	3.8
CO_2	23.6	24.4	24.8	25.2	25.2	24.8	25.2	25.0	25.6	25.2	25.6	22.0
N_2	74.1	74.4	72.0	72.6	72.2	72.3	72.2	71.8	72.9	72.1	72.2	74.2

(1) Determined by lift line pressure drop measurements
(2) Determined by weigh scale measurements
(3) Determined by orifice flow meter measurements
(4) Density indicated by pressure tap readings

Table 19-3. REGENERATOR DATA, RUN 19 (Sheet 2 of 2)

Date	8/12	8/12	8/13	8/13	8/14	8/14	8/14	8/15	8/15	8/15	8/16	8/16	8/16
Time	1900	2300	0700	1500	0700	1500	2300	0700	1500	2300	0300	0700	1100
Jacket Steam Make, lb/hr	← 0 →												
Solids													
Feedstock	← Husky Char →			Velva Lignite	Husky Char		← Velva Lignite →						
Feed Rate, lb/hr(1)	2,400	← 2,400 →		1,900	← 1,900 →		2,300	2,400	2,400	2,200	2,200	2,200	2,200
Heating Value, Btu/lb	← 12,060 →			11,280	12,060		← 11,280 →						
Dump Acceptor, lb/hr	270	380	380	700	300	440	270	630	440	300	300	370	370
Gas Flow(2)													
Boot (Recycle), SCFH	37,100	23,000	28,400	27,000	26,400	21,400	26,100	27,200	19,700	21,700	22,600	23,000	20,300
Boot (Steam), SCFH	0	8,000	8,200	9,700	15,100	15,700	15,600	15,600	17,700	17,700	18,600	18,200	21,100
Steam to Side, SCFH	31,500	31,000	19,500	25,800	22,000	23,200	32,200	32,800	33,600	32,700	33,300	33,000	33,600
Air to Side, SCFH	14,600	24,300	20,200	25,300	18,900	18,600	0	0	0	0	0	0	0
Purges													
Recycle, SCFH	4,000	4,000	4,100	4,200	4,200	4,600	5,500	5,500	5,400	← 5,500 →			
Inert, SCFH	← 400 →												
Total Flow In, SCFH	87,600	90,700	80,800	92,400	86,600	83,900	79,400	81,500	76,800	78,000	80,400	80,100	80,900
Vent Rate, SCFH	32,200	38,500	41,200	58,800	43,700	54,900	34,000	32,200	34,300	34,200	34,700	34,000	35,200
Bed Conditions													
Boot Velocity, ft/sec	1.52	1.43	1.77	1.95	2.19	1.96	2.16	2.20	1.92	2.02	2.10	2.10	2.12
Char Bed Velocity Inlet, ft/sec	0.78	0.91	0.82	0.95	0.89	0.85	0.79	0.81	0.75	0.77	0.79	0.79	0.80
Boot Density, lb/ft3(3)	101	102	98	98	93	90	86	63	81	80	78	78	78
Char Bed Density, lb/ft3(3)	47	45	43	35	32	34	35	35	33	35	36	36	37
Boot Temperature, °F	1090	1240	1330	1500	1485	1500	1463	1465	1462	1460	1455	1450	1455
Char Bed Temperature, °F	1266	1461	1503	1508	1517	1522	1501	1506	1489	1501	1497	1495	1497
Overhead Gas Composition, Mol %													
O_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	8.6	16.8	21.5	19.0	17.0	19.2	14.9	14.7	15.1	13.4	12.9	12.9	13.2
CO_2	18.6	15.0	14.2	13.7	13.6	9.3	8.3	8.1	9.0	9.2	9.0	8.1	8.1
N_2	39.6	34.7	34.5	32.7	34.4	25.0	5.9	5.1	7.2	5.0	4.5	4.4	4.5
H_2	21.9	29.5	26.1	29.6	31.0	39.4	57.2	58.0	54.8	58.8	59.5	60.4	60.4
CH_4	11.3	4.0	3.7	5.0	4.0	7.1	13.7	14.1	13.9	13.6	13.7	14.2	13.8
H_2O Mol Fraction						14.6			27.9	28.8	29.3	27.5	27.0

(1) Calculated by feeder RPM
(2) Determined by orifice flow meter measurements
(3) Density indicated by pressure tap readings

Table 19-4. GASIFIER DATA, RUN 20

Date	8/12	8/12	8/13	8/13	8/14	8/14	8/14	8/15	8/15	8/15	8/16	8/16	8/16
Time	1900	2300	0700	1500	0700	1500	2300	0700	1500	2300	0300	0700	1100
Jacket Steam Make, lb/hr	280	350	380	410	410	380	350	350	320	350	350	340	340
Solids	← Dead-Burned Dolomite →				← 6 X 9 Dolomite →								
Acceptor Feedstock	← 300 →				← 600 →								
Acceptor Makeup, lb/hr	7,900	9,100	10,800	12,000	12,900	13,700	17,000	15,800	14,600	14,600	13,800	14,000	13,500
Acceptor Circulation, lb/hr(1)	15	20	20	100	70	120	120	80	80	110	100	100	120
Ash & Attrited Acceptor, lb/hr(2)													
Gas Flows(3)													
Acceptor Lift, SCFH	64,900	64,600	64,600	52,300	52,200	53,000	51,800	51,400	52,800	52,700	52,800	53,200	52,800
Char Lift, SCFH	7,530	7,410	7,550	7,580	7,220	7,290	7,400	7,660	7,460	7,460	7,480	7,490	7,490
Air Line													
Recycle, SCFH	58,500	21,200	21,200	28,300	36,600	18,000	0	0	0	0	0	0	0
Air, SCFH	50,100	49,300	49,900	52,000	60,700	66,700	77,700	78,400	77,600	77,000	77,000	77,600	77,700
Purges	430	← 420 →			430	420	← 410 →						
Recycle, SCFH						1,530							
Inert, SCFH						850							
Nitrogen, SCFH													
Total Flow In, SCFH	183,800	145,300	146,000	143,000	159,500	147,800	139,700	140,300	140,700	140,000	140,000	141,000	140,800
Vent Rate, SCFH	57,300	60,400	59,200	59,000	74,500	88,200	97,900	101,500	103,600	103,000	103,000	103,500	103,200
Bed Conditions													
Gas Velocity Inlet, ft/sec	2.88	2.72	2.76	2.69	2.96	2.66	2.82	2.84	2.86	2.81	2.83	2.76	2.85
Bed Density, lb/ft3(4)	105	113	108	105	105	99	96	90	90	90	89	89	85
Average Bed Temperature, °F	1478	1853	1873	1836	1813	1823	1863	1858	1861	1860	1854	1854	1861
Overhead Gas Analysis, Mol %													
O_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	5.4	2.8	2.6	3.5	2.3	3.7	2.7	1.4	2.9	2.0	1.75	1.25	1.70
CO_2	15.2	18.4	18.4	20.0	20.2	13.0	26.6	28.2	27.4	27.0	28.0	25.0	27.8
N_2	79.4	78.8	79.0	76.5	77.5	83.3	70.7	70.4	69.7	71.0	70.25	73.75	70.5

(1) Determined by lift line pressure drop measurements
(2) Determined by weigh scale measurements
(3) Determined by orifice flow meter measurements
(4) Density indicated by pressure tap readings

Table 19-5. REGENERATOR DATA, RUN 20

Date	9/1	9/2	9/2	9/2	9/3	9/3	9/3	9/4	9/4	9/4	9/5	9/5	9/5	9/6	9/6	9/6	9/7
Time	1900	0300	1500	2300	0700	1500	2300	0700	1500	2300	0700	1500	2300	0700	1500	2300	0700
Jacket Steam Make, lb/hr	←								0								→
Solids																	
Feedstock	← Husky Char →			←						Velva Lignite							→
Feed Rate, lb/hr(1)	1,920	1,800	1,325	2,400	2,000	2,670	2,700	2,420	1,410	3,000	2,020	2,320	2,500	2,500	2,500	2,320	2,320
Heating Value, Btu/lb	←	12,060	→	←						10,900							→
Dump Acceptor, lb/hr	190	190	425	425	280	280	460	340	350	330	330	350	350	350	350	380	380
Gas Flow(2)																	
Boot (Recycle), SCFH	39,100	38,600	31,000	31,800	13,100	16,200	16,800	18,600	21,000	18,900	17,900	17,900	20,500	19,800	17,100	20,700	20,000
Boot (Steam), SCFH	0	0	6,400	13,800	16,600	18,300	17,300	18,000	18,500	17,600	19,800	19,300	19,900	20,000	21,400	18,800	20,000
Steam to Side, SCFH	29,200	27,200	26,900	24,500	21,800	20,700	20,700	20,700	16,800	17,500	17,500	31,500	31,700	31,700	31,000	31,000	31,000
Air to Side, SCFH	0	9,400	25,600	29,100	24,900	25,000	19,300	8,800	0	0	0	0	0	0	0	0	0
Purges																	
Recycle, SCFH	3,500	3,500	4,200	4,200	4,200	4,200	4,500	4,800	5,300	5,000	5,000	5,000	5,300	5,200	5,200	5,400	5,500
Inert, SCFH	←								400								→
Total Flow In, SCFH	72,200	79,100	94,500	85,800	81,000	84,800	79,000	71,300	62,000	59,400	60,600	74,100	77,800	77,100	75,100	76,300	76,900
Vent Rate, SCFH	0	10,200	48,400	69,700	72,700	63,300	69,300	51,700	28,400	52,700	47,800	51,000	43,000	51,200	45,900	35,000	36,200
Bed Conditions																	
Boot Velocity, ft/sec	1.29	1.47	1.88	1.46	1.57	1.82	1.82	1.94	2.08	1.94	2.02	1.99	2.14	2.12	2.05	2.11	2.13
Char Bed Velocity Inlet, ft/sec	0.48	0.58	0.91	0.88	0.81	0.83	0.80	0.71	0.60	0.58	0.59	0.74	0.77	0.77	0.74	0.75	0.76
Boot Density, lb/ft^3(3)	101	99	90	84	84	90	92	90	90	81	83	83	80	80	78	75	75
Char Bed Density, lb/ft^3(3)	44	44	50	38	31	35	33	35	35	38	36	36	36	39	36	36	37
Boot Temperature, °F	850	1055	1400	1505	1490	1500	1518	1510	1490	1515	1525	1520	1511	1510	1510	1518	1515
Char Bed Temperature, °F	876	1010	1457	1515	1488	1488	1511	1505	1486	1496	1512	1504	1490	1500	1484	1496	1495
Overhead Gas Composition, Mol %																	
CO	-	0.6	14.4	16.5	18.0	16.4	19.1	15.8	12.2	14.7	14.4	13.6	14.2	12.4	13.1	13.5	12.2
CO_2	-	22.6	14.3	15.4	14.4	14.0	12.1	10.9	9.8	8.9	9.1	9.1	9.0	8.4	9.2	8.6	8.2
N_2	-	73.3	37.6	33.4	27.4	31.5	23.5	16.6	11.2	14.3	15.4	14.2	7.8	14.7	14.5	9.3	7.9
H_2	-	2.4	27.8	31.4	33.8	31.1	37.8	46.3	55.6	49.4	50.4	51.7	54.7	52.5	51.6	55.4	57.9
CH_4	-	1.1	3.9	3.3	6.4	6.8	7.5	10.4	11.2	12.7	10.7	11.4	14.2	12.0	11.6	13.2	13.8
C_2H_6	-	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H_2O Mol Fraction	12.2	19.8	20.6	23.5	21.22	20.9	19.9	24.7	30.7	23.2	24.9	26.2	25.7	26.6	26.4	26.3	28.2

(1) Calculated by feeder RPM
(2) Determined by orifice flow meter measurements
(3) Density indicated by pressure tap readings

Table 19-6. GASIFIER DATA, RUN 21 (Sheet 1 of 2)

Date	9/7	9/7	9/8	9/8	9/8	9/9	9/9	9/9	9/10	9/10	9/10	9/11	9/11	9/11	9/12	9/12	9/12
Time	1500	2300	0700	1500	2300	0700	1500	2300	0700	1500	2300	0700	1500	2300	0700	1500	2300
Jacket Steam Make, lb/hr	←								0								→
Solids	←								Velva Lignite								→
Feedstock																	
Feed Rate, lb/hr(1)	2,120	2,070	2,420	2,320	2,220	2,270	2,320	2,320	2,240	2,320	2,520	2,470	2,320	2,320	2,520	2,520	2,420
Heating Value, Btu/lb	←								10,900								→
Dump Acceptor, lb/hr	380	300	380	300	300	320	360	360	360	360	340	340	340	320	320	320	380
Gas Flow(2)																	
Boot (Recycle), SCFH	17,300	20,000	19,400	15,000	15,800	16,600	14,100	15,400	14,700	13,600	15,600	17,600	16,400	14,500	15,800	11,600	11,500
Boot (Steam), SCFH	20,400	19,500	20,000	19,600	19,000	19,400	20,200	19,200	19,000	19,000	18,100	18,000	18,400	19,500	21,000	21,300	20,300
Steam to Side, SCFH	31,700	32,000	31,300	37,200	37,700	37,600	38,600	38,500	37,600	37,500	39,000	38,900	39,000	38,900	39,000	31,100	28,300
Air to Side, SCFH	←								0							7,000	7,000
Purges																	→
Recycle, SCFH	5,500	5,700	5,500	5,500	5,500	5,300	5,500	5,700	5,600	5,600	5,600	5,700	5,400	5,600	5,700	4,500	5,000
Inert, SCFH	←								400								→
Total Flow In, SCFH	75,300	77,600	76,600	77,700	78,400	79,300	78,800	79,200	77,300	76,100	78,700	80,600	79,600	78,900	81,900	75,900	72,500
Vent Rate, SCFH	31,000	31,700	30,800	30,900	33,800	31,000	35,900	35,800	33,100	41,000	32,300	32,300	48,300	41,200	40,700	44,000	49,900
Bed Conditions																	
Boot Velocity, ft/sec	2.00	2.09	2.07	1.86	1.86	1.89	1.82	1.84	1.78	1.74	1.80	1.92	1.90	1.84	1.97	1.79	1.73
Char Bed Velocity Inlet, ft/sec	0.79	0.76	0.75	0.76	0.77	0.76	0.78	0.78	0.76	0.74	0.76	0.79	0.79	0.78	0.80	0.76	0.72
Boot Density, lb/ft3(3)	75	74	75	75	75	75	77	74	77	77	77	77	74	74	75	75	72
Char Bed Density, lb/ft3(3)	36	38	40	38	38	39	39	39	39	40	41	42	42	41	42	42	42
Boot Temperature, °F	1515	1504	1485	1530	1512	1495	1506	1515	1495	1525	1515	1535	1560	1545	1523	1560	1555
Char Bed Temperature, °F	1486	1485	1478	1483	1482	1484	1496	1491	1478	1461	1464	1471	1490	1490	1468	1502	1505
Overhead Gas Composition, Mol %																	
CO	11.7	11.4	9.5	11.5	10.8	13.9	12.9	11.3	11.6	11.5	11.0	10.9	11.0	12.4	11.0	26.2	14.1
CO_2	8.9	7.6	8.7	9.1	9.4	9.8	9.5	8.9	9.7	8.4	8.6	7.7	8.5	9.1	8.7	11.8	9.1
N_2	4.9	6.0	7.9	5.7	6.0	5.1	4.0	4.3	4.9	6.5	5.2	3.3	12.3	4.2	3.2	14.6	15.4
H_2	59.8	60.5	56.5	59.4	59.0	55.7	59.1	61.2	58.7	58.4	58.7	62.2	55.5	59.2	60.3	35.6	50.0
CH_4	14.7	14.5	17.4	14.3	14.7	15.5	14.1	14.3	15.1	15.1	16.3	15.9	12.6	15.1	16.7	11.8	11.4
C_2H_6	0.0	0.0	0.0	0.0	0.1	0.0	0.4	0.0	0.0	0.1	0.04	0.04	0.1	0.04	0.1	0.0	0.0
H_2O Mol Fraction	31.1	28.5	33.4	31.7	33.6	28.0	30.6	32.6	32.4	28.7	30.4	29.8	30.0	30.3	31.4	14.1	24.9

(1) Calculated by feeder RPM
(2) Determined by orifice flow meter measurements
(3) Density indicated by pressure tap readings

Table 19-6. GASIFIER DATA, RUN 21 (Sheet 2 of 2)

Date	9/1	9/2	9/2	9/2	9/3	9/3	9/3	9/4	9/4	9/4	9/5	9/5	9/5	9/6	9/6	9/6	9/7
Time	1900	0310	1500	2300	0700	1500	2300	0700	1500	2300	0700	1500	2300	0700	1500	2300	0700
Jacket Steam Make, lb/hr	270	250	280	340	360	390	380	370	370	370	360	360	350	350	360	300	330
Solids																	
Acceptor Feedstock	← Dead-Burned Dolomite →					← 6 X 9 Dolomite →											
Acceptor Makeup, lb/hr	150	900	600	300	300	600	600	600	0				← 600 →				
Acceptor Circulation, lb/hr(1)	7,500	7,780	9,450	13,600	13,000	13,600	13,600	14,200	12,200	15,300	14,450	13,000	13,000	12,200	10,300	10,300	10,000
Ash & Attrited Acceptor, lb/hr(2)	0	0	40	50	50	80	90	100	80	60	110	110	110	120	100	130	105
Gas Flows(3)																	
Acceptor Lift, SCFH	60,300	60,000	58,000	58,300	58,700	58,000	57,500	57,000	53,700	52,500	54,000	53,100	53,000	53,000	53,500	53,700	53,000
Char Lift, SCFH	7,400	7,400	7,400	7,500	7,500	7,400	7,600	7,600	7,600	7,700	7,600	7,500	← 7,600 →				
Air Line																	
Recycle, SCFH	73,900	72,500	44,000	32,600	30,200	12,600	11,900	← 0 →									
Air, SCFH	0	13,200	66,000	56,400	59,800	63,600	65,900	68,900	60,700	73,200	72,800	75,800	77,300	77,500	71,900	72,500	74,200
Purges																	
Recycle, SCFH	← 450 →				← 420 →			450	410	420	← 410 →						
Inert, SCFH								1,530									
Nitrogen, SCFH								850									
Total Flow In, SCFH	144,000	156,000	178,000	166,600	159,000	144,400	145,700	136,300	124,800	136,200	137,200	139,200	140,300	140,500	135,400	136,200	137,200
Vent Rate, SCFH	7,000	22,100	77,400	66,600	70,000	81,500	85,200	92,000	77,900	95,700	99,300	100,600	102,400	105,000	100,700	96,800	101,300
Bed Conditions																	
Gas Velocity Inlet, ft/sec	1.83	1.89	3.17	2.87	2.86	2.65	2.66	2.49	2.27	2.50	2.52	2.55	2.58	2.58	2.49	2.53	2.54
Bed Density, lb/ft3(4)	105	102	105	101	105	95	98	93	87	86	84	78	81	80	72	71	75
Average Bed Temperature, °F	1136	1067	1770	1831	1800	1853	1838	1837	1832	1851	1854	1842	1849	1844	1850	1870	1862
Overhead Gas Analysis, Mol %																	
O_2	0.05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	0.1	0.8	1.2	1.4	2.3	2.1	2.2	2.1	2.2	1.9	2.3	2.2	1.9	2.4	3.5	2.7	2.7
CO_2	11.0	14.2	19.5	18.4	18.0	20.4	23.2	25.5	23.6	29.6	18.6	25.3	26.0	26.2	25.5	26.0	26.0
N_2	88.5	85.0	79.3	80.2	79.7	77.5	74.6	72.4	74.2	68.5	79.1	72.5	72.1	71.4	71.0	71.3	71.3

(1) Determined by lift line pressure drop measurements
(2) Determined by weigh scale measurements
(3) Determined by orifice flow meter measurements
(4) Density indicated by pressure tap readings

Table 19-7. REGENERATOR DATA, RUN 21 (Sheet 1 of 2)

Date	9/7	9/7	9/8	9/8	9/8	9/9	9/9	9/9	9/10	9/10	9/10	9/11	9/11	9/11	9/12	9/12	9/12
Time	1500	2300	0700	1500	2300	0700	1500	2300	0700	1500	2300	0700	1500	2300	0700	1500	2300
Jacket Steam Make, lb/hr	360	340	320	330	340	330	340	340	340	360	320	320	300	300	300	320	310
Solids									6 X 9 Dolomite								
Acceptor Feedstock									600								
Acceptor Makeup, lb/hr																	
Acceptor Circulation, lb/hr[1]	11,100	10,800	10,300	11,100	11,100	10,600	11,700	10,600	11,400	11,400	11,100	11,100	11,700	10,600	10,600	10,300	10,300
Ash & Attrited Acceptor, lb/hr[2]	100	130	120	110	130	120	150	125	140	75	140	145	120	130	125	130	120
Gas Flows[3]																	
Acceptor Lift, SCFH	52,600	53,600	54,000	53,900	54,000	54,000	53,500	53,700	53,400	53,300	54,000	53,900	53,900	52,900	52,900	52,900	53,000
Char Lift, SCFH	7,600	7,600	7,700	7,600	7,600	7,700	7,600	7,600	7,400	7,500	7,500	7,500	7,600	7,500	7,500	7,700	7,600
Air Line									0								
Recycle, SCFH																	
Air, SCFH	78,900	75,100	77,500	75,800	78,500	76,200	77,800	77,200	77,900	75,000	79,000	77,900	77,800	81,000	78,800	74,800	72,700
Purges									410								
Recycle, SCFH									1,530								
Inert, SCFH									850								
Nitrogen, SCFH																	
Total Flow In, SCFH	141,500	138,700	141,600	139,700	142,500	140,300	141,300	140,900	141,000	138,200	142,900	141,700	141,700	143,800	141,600	137,800	135,700
Vent Rate, SCFH	99,300	101,000	101,100	100,000	103,500	103,000	103,600	100,700	103,700	102,000	102,600	102,000	103,000	98,500	106,100	101,500	99,200
Bed Conditions																	
Gas Velocity Inlet, ft/sec	2.51	2.56	2.60	2.57	2.63	2.59	2.60	2.70	2.60	2.51	2.64	2.62	2.61	2.67	2.61	2.54	2.51
Bed Density, lb/ft^3[4]	71	72	71	71	72	72	72	76	75	74	75	74	74	74	75	72	74
Average Bed Temperature, °F	1840	1860	1843	1848	1853	1857	1853	1850	1858	1820	1856	8158	1855	1865	1854	1851	1860
Overhead Gas Analysis, Mol %																	
O_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	2.5	2.6	2.2	2.7	2.2	2.8	2.3	2.3	1.7	4.0	3.0	2.4	2.1	1.6	1.7	3.1	2.3
CO_2	27.0	26.8	27.0	28.0	27.4	27.0	28.2	27.4	28.2	27.6	28.0	27.6	28.6	29.2	29.2	28.4	28.3
N_2	70.5	70.6	70.8	69.3	70.4	70.2	69.5	70.3	70.1	68.4	69.0	70.0	69.3	69.2	69.1	68.5	69.4

(1) Determined by lift line pressure drop measurements
(2) Determined by weigh scale measurements
(3) Determined by orifice flow meter measurements
(4) Density indicated by pressure tap readings

Table 19-7. REGENERATOR DATA, RUN 21 (Sheet 2 of 2)

Date 7/8 - 7/15

	Dead-Burned	Raw Dolomite		Char	Lignite
Screen Size, Wt % Tyler Mesh			Screen Size, Wt % Tyler Mesh		
+4	Tr	0	+6	0	0
4 X 6	Tr	Tr	6 X 8	Tr	.1
6 X 8	Tr	32.2	8 X 10	.4	0.4
8 X 9	Tr	28.2	10 X 14	11.7	11.7
9 X 10	2.0	22.7	14 X 20	18.1	16.5
10 X 12	17.2	11.5	20 X 28	20.9	19.1
12 X 14	29.0	3.8	28 X 35	17.4	17.1
14 X 16	19.7	.9	35 X 48	15.0	16.1
16 X 20	16.3	.3	48 X 65	8.6	10.6
20 X 24	6.1	.2	65 X 100	3.5	3.6
24 X 28	2.5	.1	100 X 200	3.2	3.8
-28	7.6	Tr	-200	1.5	1.2
Particle Density, lb/cu ft	195.3	171.8			66.6
Ultimate Analysis, Wt %					
Moisture				1.02	1.56
C				75.66	65.83
H				2.55	4.38
S				1.78	0.64
Ash + SO_3				13.74	6.46
Elemental Analysis, Wt %					
SiO_2	1.47	4.7		24.19	28.68
SO_3	0.03	.5		26.45	9.84
Na_2O	0.02	.04		1.39	1.33
CaO	56.36	54.44		26.75	34.16
MgO	38.96	36.45		8.72	8.58
K_2O	0.01	0.23		0.18	0.36
P_2O_5	0.10	0.02		0.04	0.20
Al_2O_3	0.68	1.46		9.48	12.50
Fe_2O_3	1.47	0.81		3.98	4.99
TiO_2	0.05	0.02		0.44	0.52

Table 19-8. FEEDSTOCK COMPOSITES, RUN 19

Date 8/9 - 8/16

	Dolomite				Lignite	
	Dead-Burned		6 X 9			
Screen Size, Wt % Tyler Mesh	Avg	Std Dev	Avg	Std Dev	Screen Size, Wt % Tyler Mesh	Avg	Std Dev
+4			0.3	0.05	+6		
4 X 6	0.02	0.04	33.0	9.8	6 X 8	0.50	0.35
6 X 8	0.38	0.60	28.0	1.2	8 X 10	11.5	4.3
8 X 9	9.2	4.9	24.7	5.2	10 X 14	14.1	4.1
9 X 10	28.7	7.0	10.2	3.8	14 X 20	15.6	3.2
10 X 12	30.8	4.3	2.8	1.0	20 X 28	14.5	1.4
12 X 14	12.6	2.9	0.7	0.17	28 X 35	15.2	2.0
14 X 16	7.3	4.0	0.3	0.16	35 X 48	10.1	2.5
16 X 20	3.3	2.3	0.2	0.09	48 X 65	5.8	2.1
20 X 24	1.1	1.0	0.1	0.05	65 X 100	6.9	3.0
24 X 28	5.6	6.3	0.2	0.38	100 X 200	5.9	3.8
-28					-200	69.7	
Particle Density, lb/cu ft	199		163				
Heat of Combustion, Btu/lb						11,338	504
Ultimate Analysis, Wt %							
Moisture						2.06	1.72
C						67.12	3.45
H						4.22	0.56
S						0.91	0.49
Ash + SO_3						8.87	1.78
Elemental Analysis, Wt %							
SiO_2	1.07		4.71			26.35	3.65
CaO	58.45		53.69			12.67	6.35
MgO	38.97		37.42				
Na_2O	0.02		0.07			1.54	0.10
Fe_2O_3	1.64		1.00				
Al_2O_3	0.27		0.34				
P_2O_5	0.01		0.01				
TiO_2	0.01		0.01				
K_2O	0.01		0.14				
SO_3	0.03		0.70				

Table 19-9. FEEDSTOCK COMPOSITES, RUN 20

Date 9/2 - 9/13

Screen Size, Wt % Tyler Mesh	Dolomite Dead-Burned Avg	Dolomite Dead-Burned Std Dev	Dolomite 6 X 9 Avg	Dolomite 6 X 9 Std Dev	Screen Size, Wt % Tyler Mesh	Lignite Avg	Lignite Std Dev
+4					+6		
4 X 6					6 X 8	0.02	0.06
6 X 8	0.02	0.04	33.7	5.9	8 X 10	0.98	1.7
8 X 9	0.38	0.60	29.2	2.8	10 X 14	11.1	3.7
9 X 10	9.2	4.9	23.3	3.1	14 X 20	12.3	2.7
10 X 12	28.7	7.0	9.6	2.8	20 X 28	13.6	1.4
12 X 14	30.8	4.3	2.6	1.2	28 X 35	13.8	1.1
14 X 16	12.6	2.9	0.63	0.28	35 X 48	14.5	2.8
16 X 20	7.3	4.0	0.25	0.16	48 X 65	11.7	1.9
20 X 24	3.3	2.3	0.18	0.26	65 X 100	6.2	3.4
24 X 28	1.1	1.0	0.6	0.05	100 X 200	10.9	2.8
-28	5.6	6.3	0.12	0.28	-200	6.2	2.4
Particle Density, lb/cu ft	200		164			71.2	
Heat of Combustion, Btu/lb						10,706	396
Ultimate Analysis, Wt %							
Moisture						1.50	0.90
C						63.63	2.01
H						4.29	0.74
S						0.74	0.31
Ash + SO_3						8.65	1.93
Elemental Analysis, Wt %							
SiO_2	1.81		5.61			29.26	2.94
CaO	57.14		54.26			11.11	4.00
MgO	37.46		37.15				
Na_2O	0.03		0.08			1.24	0.14
Fe_2O_3	1.65		1.05				
Al_2O_3	0.84		0.92				
P_2O_5	0.04		0.01				
TiO	0.08		0.03				
K_2O	0.02		0.10				
SO_3	1.31		0.65				

Table 19-10. FEEDSTOCK COMPOSITES, RUN 21

Date Time	7/8 0800	7/9 0800	7/10 0800	7/10 1500	7/11 2000	7/12 1000	7/12 2000	7/15 1940	7/16 0800
Screen Size, Wt % Tyler Mesh									
+4	0	0	0	0	0.4	0	0	0	0
4 X 6	0	0	0	0	0.4	0	.1	0	0
6 X 8	0.1	0.2	0.2	0.2	0.4	2.2	4.3	11.8	12.6
8 X 9	Tr	0.1	0.2	0.1	0.3	2.3	4.6	16.2	16.8
9 X 10	3.5	6.2	6.9	7.3	7.6	7.9	8.4	19.3	19.6
10 X 12	22.1	29.6	30.4	32.7	30.0	25.1	25.2	17.1	15.2
12 X 14	32.2	34.4	34.0	34.1	34.1	29.6	28.6	13.1	12.2
14 X 16	20.1	17.4	16.9	15.6	16.5	16.9	15.5	6.4	6.0
16 X 20	14.1	8.5	8.5	7.2	7.8	9.7	8.2	3.2	3.3
20 X 24	4.7	1.9	1.8	1.5	1.6	2.4	2.1	1.8	1.8
24 X 28	1.9	0.6	0.5	0.4	0.4	0.9	0.8	2.1	2.4
+28	1.3	1.0	0.7	0.7	0.6	3.0	2.3	8.8	10.0

Date Time	7/8 2000	7/9 2000	7/10 1500	7/11 2000	7/12 2000	7/13 2100	7/14 2000	7/15 1940	7/16 0800
Particle Density, lb/cu ft	194.9	189.7	198.1	194.8	173.5	129.0	123.8	122.7	137.9
% Calcine Weight Change	-0.01	+0.12	+0.12	+0.04	-0.74	-1.05	-2.2	-1.8	-2.63
Elemental Analysis, Wt %									
Total S	0.95	1.72	0	2.30	0.11	4.87	0.16	5.90	8.53
SiO_2	0.08	0.47	2.65	0.43	3.67	0.64	6.41	0.34	0.35
SO_3	0.02	0.02	0.38	0.04	0.59	0.07	0.48	0.05	0.17
Na_2O	58.06	56.97	0.02	57.18	0.04	54.62	0.06	54.35	53.69
CaO	38.60	37.85	57.22	37.18	56.85	36.74	54.52	34.65	33.51
MgO	0.01	0.01	36.53	0.01	36.65	0.04	35.82	0.04	0.20
K_2O	0.01	0.01	0.01	0.01	0.02	0.02	0.05	0.03	0.04
P_2O_5	0.72	0.95	0.01	1.15	0.02	1.90	0.02	2.34	2.64
Al_2O_3	1.46	1.56	1.21	1.93	1.09	1.34	0.83	1.27	1.31
Fe_2O_3	0.18	0.17	1.61	0.10	1.60	0.14	1.23	0.10	0.10
TiO_2			0.22		0.20		0.13		

Table 19-11. CALCINED ACCEPTOR RETURN, RUN 19

Date Time	7/8 0800	7/9 1200	7/10 0800	7/10 1600	7/10 2000	7/11 2000	7/14 2000	7/15 2000	7/16 2000
Screen Size, Wt % Tyler Mesh									
+4	0	0	0	0	0	0	0	0	0
4 X 6	0	Tr	Tr	Tr	Tr	0	Tr	0	0
6 X 8	0	Tr	Tr	Tr	0.1	0	9.0	10.4	9.0
8 X 9	0.1	Tr	0.1	Tr	Tr	0.1	15.8	18.6	17.8
9 X 10	3.8	5.6	4.1	3.3	4.1	3.2	19.4	21.9	23.0
10 X 12	22.2	25.1	22.7	20.7	21.3	19.1	17.9	18.0	18.8
12 X 14	31.8	30.8	31.5	30.7	29.6	29.9	15.4	14.3	15.8
14 X 16	20.2	19.4	20.1	21.3	19.5	21.4	8.7	6.7	7.2
16 X 20	14.3	12.9	13.3	15.3	13.5	16.3	4.9	3.6	3.6
20 X 24	4.7	3.8	4.2	4.9	4.2	5.5	2.2	1.8	1.9
24 X 28	1.9	1.6	1.7	2.0	5.8	2.3	2.2	2.0	1.7
-28	0.9	0.9	2.3	1.8	1.8	2.2	4.5	2.9	1.2
Date Time	7/8 2000	7/9 2000	7/10 1600	7/11 2000	7/12 2000	7/13 2000	7/14 2000	7/15 2000	7/16 0400
Particle Density, lb/cu ft	197.3	190.2	191.8	190.8	189.4	162.2	135.3	134.6	134.5
Activity					0.05	0.18	0.23	0.27	0.23
% Calcine Weight Change	-1.05	-0.91	-0.77	-0.62	-5.5	-6.4	-8.0	-9.1	-8.6
Elemental Analysis, Wt %									
Total S as Received			0.17		0.16		0.20		0.08
SiO_2	1.29	1.75	2.29	2.75	3.63	5.77	8.23	8.26	6.33
SO_3	0.44	0.83	0.33	0.57	0.42	0.25	0.37	0.42	0.26
Na_2O	0.02	0.02	0.02	0.02	0.03	0.04	0.07	0.07	0.05
CaO	55.07	56.33	57.35	56.87	56.68	53.74	54.20	54.39	54.35
MgO	40.19	38.78	37.03	36.75	37.32	36.13	34.59	34.09	35.09
K_2O	0.01	0.01	0.01	0.01	0.02	0.04	0.06	0.06	0.04
P_2O_5	0.02	0.01	0.01	0.01	0.03	0.03	0.03	0.03	0.04
Al_2O_3	0.69	0.89	1.16	0.93	1.50	1.85	2.24	2.37	2.24
Fe_2O_3	1.66	1.63	1.52	1.59	1.60	1.48	1.39	1.30	1.20
TiO_2	0.07	0.09	0.09	0.20	0.05	0.10	0.12	0.12	0.10

Table 19-12. RECARBONATED ACCEPTOR RETURN, RUN 19

Date	8/12	8/12	8/13	8/14	8/14	8/14	8/15	8/15	8/15	8/15	8/16	8/16
Time	0200	1000	0935	0800	1400	2000	0200	0800	1400	2000	0200	0830
Screen Size, Wt %												
Tyler Mesh												
+4					0.1							
4 X 6				2.5	2.1	3.9	8.1	10.6	11.8	6.9	9.4	13.3
6 X 8	0.6	1.8	0.4	3.5	3.6	6.8	11.8	13.7	15.2	13.4	20.6	16.4
8 X 9	0.6	1.6	0.6	19.3	18.5	22.8	25.5	24.8	25.9	26.6	25.6	24.1
9 X 10	11.0	17.3	16.0	34.9	37.1	32.1	26.9	24.4	23.4	24.4	20.8	18.6
10 X 12	31.6	39.5	39.5	25.7	27.5	23.3	17.8	15.7	14.6	15.9	11.9	12.8
12 X 14	30.9	27.3	30.1	7.4	7.1	6.5	5.1	4.7	4.5	5.7	5.0	5.5
14 X 16	12.5	7.7	8.2	4.1	2.8	2.8	2.4	2.3	2.1	2.8	2.3	2.8
16 X 20	2.7	3.6	3.7	1.1	0.6	0.7	0.6	0.8	0.6	0.9	0.9	1.4
20 X 24	2.1	0.9	0.9	0.5	0.2	0.3	0.4	0.6	0.5	0.7	0.6	1.3
24 X 28	0.5	0.2	0.2	1.0	0.3	0.7	1.4	2.4	1.4	2.7	2.8	3.9
-28	2.3	0.1	0.4									
Particle Density, lb/cu ft		200.2	200.9	196.1				164.4				146.4
Activity				0.05								
% Calcine Weight Change		-1.53	-0.19	-7.25				-1.82				-2.27
Elemental Analysis, Wt %												
SiO_2		0.63	0.97	3.22				4.55				6.02
SO_3		0.02	0.02	0.19				0.67				0.96
Na_2O		0.01	0.02	0.04				0.06				0.08
CaO		57.96		55.97								53.32
MgO		39.34		37.38								36.82
K_2O		0.01		0.03								0.06
P_2O_5		0.01		0.01								0.02
Al_2O_3		0.26		0.33								0.33
Fe_2O_3		1.91		1.99								1.49
TiO_2		0.01		0.01								0.02

Table 19-13. CALCINED ACCEPTOR RETURN, RUN 20

Date	8/13	8/13	8/14	8/14	8/14	8/14	8/15	8/15	8/15	8/15	8/15	8/15	8/16
Time	0800	1200	0800	1200	1600	2000	0000	0400	0800	1200	1600	2400	0400
Screen Size, Wt % Tyler Mesh													
+4						0.1							
4 X 6						0							
6 X 8	0.2	0.2	0.8	2.2	3.5	4.1	6.3	4.1	6.2	6.8	7.8	8.1	6.8
8 X 9	0.4	0.4	1.7	3.4	5.6	5.8	8.8	8.5	11.2	11.8	13.0	14.0	13.3
9 X 10	11.1	12.4	13.3	16.8	8.7	18.8	20.0	19.6	23.7	23.9	24.7	25.8	25.7
10 X 12	31.2	32.6	31.0	31.0	34.8	30.2	28.3	28.5	26.2	25.0	25.1	23.8	24.0
12 X 14	32.9	32.7	31.0	28.7	29.7	24.7	22.3	23.2	19.9	19.2	18.1	16.7	17.0
14 X 16	12.9	12.1	12.2	10.1	10.7	9.0	8.5	9.2	7.4	7.3	6.2	6.6	7.2
16 X 20	8.2	7.0	7.1	5.8	5.6	5.0	4.2	4.9	3.6	3.7	3.2	3.3	3.5
20 X 24	2.2	1.9	1.8	1.4	1.2	1.3	1.2	1.3	1.0	1.1	0.8	1.1	1.2
24 X 28	0.7	0.6	0.6	0.5	0.6	0.5	0.4	0.7	0.6	0.6	0.6	0.6	0.8
-28	0.2	Tr	0.4	0.1	0.2	0.4	Tr	0	0.3	0.5	0.6	0.1	0.5
Bulk Density, lb/cu ft				97									
Particle Density, lb/cu ft	192.1		196.0	197.0	192.3	187.8	183.7	185.0	189.7	173	175.3	170.3	163.6
Activity	0.01		0.056	0.067	0.11	0.13	0.27	0.17	0.27	0.21	0.19	0.20	0.203
% Calcine Weight Change	-1.96		-2.25	-2.70	-3.72	-4.50	-5.73	-6.83	-8.2	-7.92	-7.46	-8.84	-10.32
Elemental Analysis, Wt %													
SiO_2	1.89		3.17	2.28	2.72	3.01	2.89	2.23	4.46	4.47	4.62	4.78	5.33
SO_3	0.12		0.16	0.15	0.21	0.19	0.26	0.04	0.14	0.23	0.20	0.12	0.18
Na_2O	0.03		0.02	0.03	0.03	0.03	0.04	0.07	0.07	0.05	0.05	0.04	0.05
CaO				56.31									
MgO				38.43									
K_2O				0.01									
P_2O_5				0.02									
Al_2O_3				1.62									
Fe_2O_3				1.52									
TiO_2				0.09									

Table 19-14. RECARBONATED ACCEPTOR RETURN, RUN 20

Date	9/2	9/3	9/4	9/4	9/4	9/5	9/5	9/5	9/5	9/6	9/6	9/6	9/6
Time	0200	2000	0200	1000	2030	0200	0800	1400	2000	0200	0800	1400	2000
Screen Size, Wt % Tyler Mesh													
+4							Tr						
4 X 6	0	0.1	0.1		0.4	4.6	6.3	6.1	7.0	8.2	10.5	11.2	12.0
6 X 8	0.2	1.7	1.4	6.3	10.8	9.7	11.9	13.7	15.7	16.1	19.7	20.0	22.5
8 X 9	0.5	2.1	3.2	9.5	19.0	19.6	20.9	22.5	23.5	24.0	25.4	24.3	26.7
9 X 10	10.9	13.0	13.3	19.3	24.9	23.3	22.2	22.1	22.3	20.0	19.9	18.2	17.6
10 X 12	35.4	30.2	27.6	26.3	20.1	20.6	17.7	16.5	16.9	15.2	12.3	12.0	10.5
12 X 14	33.5	28.7	27.8	21.6	9.5	10.6	8.5	8.1	7.6	6.9	5.3	5.2	4.3
14 X 16	12.0	13.0	13.3	9.5	5.3	5.6	4.2	4.3	3.6	3.5	2.3	2.5	2.0
16 X 20	5.5	7.1	7.6	4.4	1.5	1.7	1.4	1.5	1.1	1.5	0.8	1.2	1.0
20 X 24	1.3	1.7	2.2	1.2	0.9	1.0	1.0	1.4	0.9	1.1	0.7	1.3	1.0
24 X 28	0.4	0.8	1.0	0.6	1.7	3.3	5.8	3.9	1.3	3.6	3.0	4.1	2.3
-28	0.3	1.5	2.6	1.4									
% Calcine Weight Change	-1.5	-0.4			-1.1				-1.6				-1.6
Elemental Analysis, Wt %													
SiO_2	2.41	5.24			5.84				8.21				8.62
SO_3	0.14	0.22			0.02				0.20				0.27
Na_2O	0.02	0.11			0.09				0.12				0.10
CaO	57.34	56.87			56.10				55.63				53.81
MgO	38.57	36.13			35.68				32.33				33.09
K_2O	0.01	0.04			0.07				0.10				0.10
P_2O_5	0.01	0.02			0.02				0.03				0.03
Al_2O_3	0.70	1.23			1.54				1.65				2.22
Fe_2O_3	1.42	1.67			1.68				1.87				1.72
TiO_2	0.11	0.10			0.10				0.13				0.14

Table 19-15. CALCINED ACCEPTOR RETURN, RUN 21 (Sheet 1 of 3)

Date	9/7	9/7	9/7	9/7	9/8	9/8	9/8	9/8	9/9	9/9	9/9	9/9
Time	0200	0800	1400	2000	0200	0800	1400	2000	0200	0800	1400	2000
Screen Size, Wt %												
Tyler Mesh												
+4												
4 X 6		Tr				Tr						
6 X 8	13.6	10.7	12.0	12.4	12.2	11.6	11.0	16.8	12.1	11.4	12.7	15.1
8 X 9	22.0	21.2	23.8	22.8	21.3	22.7	21.8	26.8	24.5	22.6	23.2	25.8
9 X 10	22.7	22.7	26.3	25.1	22.2	24.1	25.7	23.1	24.2	24.6	24.6	24.4
10 X 12	15.7	18.0	17.8	16.9	15.6	15.8	16.1	14.2	15.9	15.8	14.9	14.2
12 X 14	10.9	12.4	10.0	10.1	10.5	10.6	10.4	9.2	9.6	10.2	9.7	8.2
14 X 16	4.9	5.2	4.0	4.5	4.9	4.6	4.2	3.6	4.3	4.2	3.8	3.1
16 X 20	2.6	2.8	1.9	2.3	3.1	2.7	2.4	2.2	2.5	2.7	2.3	1.9
20 X 24	1.3	1.5	1.0	1.4	2.2	1.7	1.4	1.4	1.6	1.8	1.4	1.1
24 X 28	1.9	1.4	0.9	1.5	2.5	1.8	1.3	1.2	1.6	2.0	1.6	1.2
-28	4.0	4.0	2.2	3.1	5.6	4.4	5.7	1.4	3.7	4.8	5.8	4.9
% Calcine Weight Change				-2.4	-1.1			-3.2				
Elemental Analysis, Wt %												
SiO_2				10.08				7.97				
SO_3				0.25				0.40				
Na_2O				0.12				0.08				
CaO				53.21				55.20				
MgO				32.13				32.28				
K_2O				0.17				0.08				
P_2O_5				0.03				0.03				
Al_2O_3				2.48				3.03				
Fe_2O_3				1.39				1.34				
TiO_2				0.14				0.11				

Table 19-15. CALCINED ACCEPTOR RETURN, RUN 21 (Sheet 2 of 3)

Date	9/10	9/10	9/10	9/10	9/11	9/11	9/11	9/11	9/12	9/12	9/12	9/12
Time	0200	0800	1400	2000	0200	0800	1400	2000	0200	0930	1400	2000
Screen Size, Wt %												
Tyler Mesh												
+4												0.1
4 X 6												14.4
6 X 8	9.5	11.3	22.8	16.6	19.6	12.4	12.7	11.0	12.5	17.5	18.8	23.6
8 X 9	21.9	22.6	32.5	25.8	25.3	22.1	25.6	22.9	24.6	26.4	27.7	20.6
9 X 10	24.4	24.2	22.9	20.8	22.6	22.7	21.3	23.1	24.3	22.2	20.2	12.8
10 X 12	15.4	15.8	12.0	13.2	13.7	15.0	14.4	14.5	14.9	13.1	10.8	8.2
12 X 14	9.8	10.3	6.1	8.5	8.8	10.3	9.0	9.2	9.5	8.0	7.1	3.9
14 X 16	10.7	4.1	2.0	3.9	3.8	4.6	4.2	3.6	3.9	3.7	3.5	2.9
16 X 20	2.1	2.6	0.9	3.0	2.6	3.4	2.8	2.8	2.7	2.4	2.5	2.1
20 X 24	1.2	1.7	0.3	2.1	1.5	2.1	1.7	1.7	1.5	1.5	1.7	2.7
24 X 28	1.0	1.9	0.3	2.2	1.6	2.2	2.0	2.3	1.6	1.5	2.1	8.8
-28	4.0	5.4	0.3	3.8	0.5	5.4	6.2	9.0	4.4	3.8	5.6	
% Calcine Weight Change				-0.5			-0.6					
Elemental Analysis, Wt %												
SiO_2				9.02			8.19					
SO_3				0.07			0.35					
Na_2O				0.13			0.12					
CaO				55.48			54.57					
MgO				32.16			32.31					
K_2O				0.16			0.15					
P_2O_5				0.04			0.04					
Al_2O_3				2.49			2.67					
Fe_2O_3				1.49			1.60					
TiO_2				0.16			0.14					

Table 19-15. CALCINED ACCEPTOR RETURN, RUN 21 (Sheet 3 of 3)

Date	9/2	9/2	9/3	9/3	9/3	9/4	9/4	9/4	9/4	9/5	9/5	9/5	9/5	9/5	9/5	9/6	9/6
Time	0300	0400	0800	1600	2000	0000	0400	0800	1600	0000	0400	0800	1200	1600	2000	0000	0400
Screen Size, Wt % Tyler Mesh																	
+4						0.1											
4 X 6	0																
6 X 8	0.4	0.3		1.3	2.2	2.6	2.3	4.3	3.9	2.1	4.1	4.1	4.0	4.9	6.0	3.7	4.8
8 X 9	0.6	0.3	0.1	1.3	2.3	4.5	5.2	6.7	7.9	5.8	9.9	11.3	11.4	12.7	13.3	13.1	15.4
9 X 10	8.4	7.8	7.8	8.1	9.6	12.2	13.0	16.7	17.5	16.4	18.6	19.7	22.1	21.5	22.3	24.7	24.1
10 X 12	29.9	27.8	27.0	25.1	24.7	27.3	24.1	22.8	24.8	23.5	23.1	22.7	22.7	21.2	22.0	22.6	22.8
12 X 14	33.6	32.1	31.0	29.1	27.8	26.8	25.5	24.3	23.0	23.3	21.5	20.2	19.1	17.6	17.3	18.1	16.7
14 X 16	14.0	15.8	17.4	16.7	16.2	13.9	14.0	13.1	11.5	13.8	12.0	10.8	9.9	9.4	8.9	9.2	8.1
16 X 20	9.3	10.7	11.2	11.6	10.9	8.7	9.3	7.7	7.1	8.6	6.5	5.9	5.4	5.5	4.9	4.5	3.8
20 X 24	2.6	3.4	3.3	3.5	3.4	2.4	2.8	2.4	2.0	2.7	1.9	2.1	1.8	2.2	1.8	1.7	1.4
24 X 28	1.0	1.3	1.3	1.5	1.4	0.9	1.5	1.2	1.2	1.8	1.4	1.6	1.5	2.1	1.8	1.3	1.3
-28	0.1	0.4	0.3	1.7	1.4	0.6	2.3	0.8	1.1	2.1	1.1	1.7	2.0	3.1	1.7	1.2	1.5
Particle Density, lb/cu ft	200			194.9	194.3		190.4	185.1	181.1	180.4	173.4	171.9	173.2	156.6	153.5	155.4	154.5
Activity	0.04			0.04	0.05	0.09	0.09	0.13	0.19	0.19	0.16	0.15	0.20	0.18	0.19	0.27	0.26
% Calcine Weight Change	-1.5			-1.63	-3.25	-3.8	-4.5	-5.6	-7.0	-6.0	-7.8	-6.4	-7.1	-7.8	-7.5	-9.1	-9.2
Elemental Analysis, Wt %																	
SiO_2	1.97			1.88	3.59	3.34	4.26	4.85	4.31	6.94	8.93	5.02	5.50	6.43	6.78	7.79	6.72
SO_3	0.23			0.12	0.19	0.16	0.30	0.22	0.16	0.25	0.50	0.25	0.28	0.40	0.47	0.33	0.35
Na_2O	0.02			0.03	0.04	0.04	0.05	0.04	0.04	0.06	0.08	0.05	0.06	0.07	0.04	0.07	0.07
CaO	58.75				57.27				56.15						54.63		
MgO	37.23				35.45				34.16						33.57		
K_2O	0.01				0.02				0.03						0.07		
P_2O_5	0.01				0.02				0.03						0.04		
Al_2O_3	0.96				2.23				1.69						2.30		
Fe_2O_3	1.37				1.74				1.62						1.64		
TiO_2					0.02				0.06						0.06		

Table 19-16. RECARBONATED ACCEPTOR RETURN, RUN 21 (Sheet 1 of 3)

Date	9/6	9/6	9/6	9/6	9/7	9/7	9/7	9/7	9/7	9/7	9/8	9/8	9/8	9/8	9/8	9/8	9/9
Time	0800	1200	1600	2000	0000	0400	0800	1200	1600	2000	0000	0400	0800	1200	1600	2000	1200
Screen Size, Wt % Tyler Mesh																	
+4																	
4 X 6																	
6 X 8	6.0	7.5	7.8	7.5	8.3	6.6	10.7	8.0	9.8	12.5	9.2	12.6	7.5	9.0	10.9	10.2	7.7
8 X 9	16.3	17.0	18.3	18.4	17.7	19.8	27.5	19.0	22.5	26.1	21.4	26.0	19.4	20.8	22.0	23.5	21.3
9 X 10	24.1	23.4	26.5	25.1	23.1	24.4	27.6	24.3	24.4	24.0	25.2	29.4	25.2	25.2	26.0	25.4	23.7
10 X 12	21.0	20.5	19.5	20.6	19.8	19.7	18.4	18.6	17.8	14.8	17.5	17.1	19.2	17.9	16.2	17.0	17.1
12 X 14	15.9	14.8	13.5	13.8	13.1	14.0	10.4	13.3	11.9	9.9	11.8	9.4	12.7	12.6	11.1	10.6	11.5
14 X 16	7.6	7.7	6.4	6.2	6.5	6.7	3.8	6.0	5.4	4.6	5.5	3.1	5.8	5.1	4.6	4.5	5.3
16 X 20	3.8	3.8	3.1	3.3	3.8	3.7	1.1	3.4	2.9	2.9	3.4	1.3	3.4	3.4	2.9	2.8	3.7
20 X 24	1.6	1.8	1.6	1.6	2.2	2.1	0.4	2.1	1.8	1.8	2.2	0.6	2.1	2.1	1.9	1.9	2.7
24 X 28	1.5	1.8	1.7	1.7	2.6	1.9	0.1	2.4	2.0	2.0	2.2	0.3	1.9	2.0	2.1	2.0	3.0
-28	2.1	1.7	1.7	1.7	2.9	1.1		2.9	1.6	1.5	1.6	0.3	2.8	1.9	2.3	2.0	4.2
Particle Density, lb/cu ft	152.0	149.2	151.0	150.7	147.5	149.3	150.3	146.6	146.4	137.1	143.4	149.4		148.2	148.7	146.5	145.3
Activity	0.26	0.25	0.26	0.27				0.28	0.30	0.29	0.27	0.36		0.30	0.34	0.30	0.28
% Calcine Weight Change	-9.4	-9.5	-9.5	-9.8	-10.4	-10.8	-11.0	-10.4	-10.5	-10.3	-10.6	-11.9		-11.0	-12.2	-11.0	-11.0
Elemental Analysis, Wt %																	
SiO_2	5.77	6.84	8.34	6.05	8.30	6.36	6.12	8.53	8.32	8.62	7.93	7.44		7.90	7.55	9.56	9.09
SO_3	0.27	0.26	0.41	0.40	0.37	0.42	0.38	0.45	0.50	0.41	0.37	0.29		0.24	0.15	0.26	0.27
Na_2O	0.04	0.06	0.07	0.04	0.07	0.06	0.05	0.07	0.06	0.06	0.06	0.05		0.07	0.07	0.07	0.09
CaO				53.05						54.07						54.21	
MgO				33.20						33.52						33.36	
K_2O				0.08						0.07						0.08	
P_2O_5				0.03						0.04						0.03	
Al_2O_3				2.23						2.43						2.48	
Fe_2O_3				1.83						1.28						1.31	
TiO_2				0.10						0.07						0.08	

Table 19-16. RECARBONATED ACCEPTOR RETURN, RUN 21 (Sheet 2 of 3)

Date	9/9	9/9	9/10	9/10	9/10	9/10	9/10	9/11	9/11	9/11	9/11	9/11	9/12	9/12	9/12	9/12	9/12	9/12
Time	1600	2000	0000	0400	0800	1200	2000	0000	0400	0800	1200	2000	0000	0400	0800	1200	1600	2000
Screen Size, Wt % Tyler Mesh																		
+4																		
4 X 6																		
6 X 8	7.2	7.6	10.5	9.4	5.3	8.1	11.4	10.5	11.5	7.7	7.1	6.6	7.8	9.9	7.5	8.6	7.7	7.4
8 X 9	19.5	19.5	23.1	22.4	17.7	22.4	23.7	24.1	23.6	20.6	20.4	17.4	23.4	24.2	22.5	23.0	21.7	24.0
9 X 10	24.6	25.3	28.4	25.0	24.9	25.0	24.9	25.8	26.7	24.7	24.4	25.8	25.7	25.8	24.6	25.5	25.0	27.0
10 X 12	17.4	16.7	15.7	17.8	18.8	18.0	16.0	17.2	15.1	17.9	18.0	18.2	17.4	16.7	17.8	17.8	16.9	17.4
12 X 14	11.7	11.2	10.5	11.5	14.0	12.0	10.5	11.2	10.6	12.2	12.3	13.3	11.5	11.1	12.0	11.4	11.5	10.8
14 X 16	5.4	5.5	4.2	4.8	6.1	4.8	4.5	4.9	4.8	5.6	5.4	6.0	5.0	4.8	5.5	4.9	4.8	4.9
16 X 20	3.8	3.7	2.6	3.2	4.1	3.3	3.3	2.8	2.9	3.7	3.9	3.5	3.4	3.0	3.8	3.4	3.1	3.2
20 X 24	2.5	2.6	1.6	1.9	2.6	2.0	2.1	1.6	1.5	2.3	2.4	2.8	2.0	1.6	2.2	1.9	1.7	1.9
24 X 28	3.4	3.2	1.9	2.0	2.9	2.3	1.9	1.4	1.7	2.6	2.9	3.1	1.9	1.6	2.5	1.9	1.8	2.0
-28	4.4	4.8	1.5	2.0	3.5	2.4	1.7	0.5	1.5	2.6	3.3	3.3	1.8	1.3	1.8	1.8	5.7	1.5
Particle Density, lb/cu ft	144.0	143.0	144.8	143.5	146.3	146.9	147.7	148.1	153.7			151.5	149.2	148.8	150.9	150.0	150.5	129.3
Activity	0.25	0.27	0.29	0.31	0.29	0.30	0.30	0.30	0.30	0.30	0.29	0.29	0.29	0.30	0.31	0.29	0.28	0.28
% Calcine Weight Change	-10.7	-10.4	-10.7	-10.9	-9.9		-10.6	-11.4	-13.4	-11.8	-10.8	-11.0	-11.4	-11.1	-11.4	-11.7	-10.5	-10.6
Elemental Analysis, Wt %																		
SiO_2	9.18	8.72	8.21	7.56	10.42	8.38	8.36	7.90	8.43	7.57	8.13	8.95	8.17	8.53	8.93	7.41	9.22	8.53
SO_3	0.22	0.37	0.30	0.38	0.38	0.28	0.20	0.26	0.19	0.24	0.31	0.31	0.30	0.24	0.13	0.26	0.37	0.42
Na_2O	0.08	0.08	0.07	0.06	0.12	0.08	0.06	0.05	0.05	0.07	0.05	0.08	0.04	0.05	0.05	0.05	0.07	0.05
CaO		53.92					53.16					54.95						
MgO		33.18					33.03					29.58						
K_2O		0.09					0.08					0.08						
P_2O_5		0.04					0.04					0.03						
Al_2O_3		4.14					4.12					4.89						
Fe_2O_3		1.26					1.15					1.32						
TiO_2		0.05					0.05					0.05						

Table 19-16. RECARBONATED ACCEPTOR RETURN, RUN 21 (Sheet 3 of 3)

Date	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/16
Time	2000	2000	2000	0000	2000	2000	2000	2000	0000	0400
Screen Size, Wt % Tyler Mesh										
+6					Tr					
6 X 8	0	0	Tr	Tr	0.9	2.9	2.9	3.3	2.1	2.8
8 X 10	Tr	Tr	0.4	0.1	3.0	9.9	12.3	14.6	7.5	10.3
10 X 14	19.7	20.7	15.1	18.6	16.3	18.3	18.0	19.6	19.5	15.1
14 X 20	19.4	22.1	16.5	20.5	15.4	11.5	9.4	9.2	12.3	6.7
20 X 28	13.4	14.1	11.2	12.2	10.0	8.6	8.6	8.8	12.5	8.4
28 X 35	12.6	12.8	13.1	12.3	12.1	11.7	12.8	12.1	14.2	13.8
35 X 48	13.9	13.6	17.1	15.0	16.8	16.4	16.9	15.3	16.5	20.1
48 X 65	9.6	8.4	14.5	11.0	11.7	10.1	9.8	8.5	8.8	12.2
65 X 100	5.0	4.1	7.5	5.5	6.6	5.3	4.7	4.0	3.8	5.9
100 X 200	4.6	3.2	4.0	3.9	5.4	4.2	3.7	3.4	2.7	4.1
-200	1.7	1.1	0.6	0.9	1.7	1.0	1.2	1.2	0.2	0.5
Particle Density, lb/cu ft				91.2						
% Char	56.3	46.2	43.0	51.0	59.4	40.2	40.2	37.4	39.4	38.2
Ash+SO_3 in Char, Wt.%	21.08	23.6	20.93	17.8	15.78	14.84	15.03	13.53	18.07	14.77
Ash Analysis, Wt.%										
SiO_2	19.67	22.54	25.50	22.15	26.62	18.89	18.60	18.87	19.65	17.77
SO_3	20.48	17.95	8.75	10.82	4.50	3.84	2.88	3.36	2.18	2.36
Na_2O	1.71	2.23	1.89	1.64	2.07	1.38	1.44	1.56	1.47	1.60

Table 19-17. REGENERATOR FUEL CHAR, RUN 19

Date	8/12	8/13	8/13	8/14	8/14	8/14	8/14	8/15	8/15	8/15	8/16	8/16
Time	2100	0800	1600	0000	0800	1600	2000	0000	0000	1600	0000	0800
Screen Size, Wt % Tyler Mesh												
+6												
6 X 8	2.0	0.1			0.3	0.8	1.0	1.0	1.9	2.3	2.1	3.0
8 X 10	9.7	1.7	2.9	0.3	11.7	3.9	7.4	5.4	8.9	10.6	8.5	13.9
10 X 14	19.3	27.0	23.8	9.6	29.0	20.2	25.7	23.8	18.7	18.4	19.9	20.8
14 X 20	12.2	16.8	12.9	8.1	14.4	9.5	9.6	9.2	9.0	8.2	8.0	8.3
20 X 28	11.4	14.6	12.2	12.4	10.3	9.7	7.4	8.2	9.2	8.6	8.7	9.1
28 X 35	13.2	13.4	14.3	18.2	10.1	13.3	10.9	11.3	12.5	12.1	12.4	12.4
35 X 48	14.7	11.7	14.3	20.9	10.1	16.2	10.2	15.0	15.3	14.8	15.1	13.2
48 X 65	9.0	7.3	9.4	14.3	6.2	11.5	11.5	10.9	10.4	10.1	9.6	8.3
65 X 100	4.1	3.2	4.9	8.0	3.3	6.8	7.8	7.4	6.5	6.9	6.5	5.0
100 X 200	3.4	3.1	4.3	6.9	3.0	6.5	7.0	7.1	6.1	6.4	7.9	5.1
-200	1.1	1.2	1.1	1.2	1.6	1.6	1.5	0.7	1.5	1.7	1.2	0.8
% Char	69.4	59.6	61.7	85.6	74.13	68.43	57.72	53.2	58.56	55.63	58.51	46.73
Ash+SO_3 in Char, Wt.%	14.90	21.13	21.10	19.52	22.35	16.29	17.58	17.26	14.92	15.07	17.74	15.3
Ash Analysis, Wt %												
SiO_2	21.06	23.96	22.28	19.29	27.80	19.68	23.94	22.89	16.26	17.61	24.03	20.53
SO_3	4.86	16.68	14.06	8.28	8.33	6.24	5.32	4.30	2.39	1.95	2.68	2.16
Na_2O	1.70	1.75	2.10	1.77	2.29	1.68	2.01	2.00	1.76	1.69	1.70	1.49

Table 19-18. REGENERATOR FUEL CHAR, RUN 20

Date	9/2	9/3	9/3	9/3	9/4	9/4	9/4	9/5	9/5	9/5	9/6	9/6	9/6	9/7	9/7	9/7
Time	2000	0000	0800	1600	0000	0800	1600	0000	0800	1600	0000	0800	1600	0000	0800	1600
Screen Size, Wt % Tyler Mesh																
+6																
6 X 8	Tr	Tr		0.2	0.4	0.9	1.3	5.1	1.2	1.5	2.1	2.0	2.7	1.6	2.2	2.6
8 X 10	0.7	1.9	1.2	1.4	2.4	5.3	6.5	7.6	8.5	10.2	11.4	12.2	12.5	9.3	13.6	13.6
10 X 14	22.3	21.8	21.3	21.4	22.4	25.7	21.6	22.6	19.1	20.1	22.7	21.6	18.4	16.0	19.1	17.2
14 X 20	16.6	14.8	14.8	15.5	14.1	15.0	12.5	12.4	10.0	9.8	8.5	8.8	7.9	7.5	6.7	7.7
20 X 28	13.0	12.3	10.5	9.7	9.6	8.8	8.8	8.7	8.2	9.0	7.2	8.7	9.9	10.3	8.8	10.5
28 X 35	12.8	14.0	14.0	11.2	11.6	10.7	11.6	11.0	11.4	12.7	10.8	11.3	13.5	14.0	13.0	14.8
35 X 48	12.8	14.7	16.1	13.9	14.8	13.0	14.3	12.9	14.8	14.8	13.4	12.6	14.0	16.1	12.8	14.6
48 X 65	8.2	4.8	8.0	8.8	9.3	5.8	9.1	7.2	8.4	2.6	8.9	7.8	7.6	9.4	8.0	7.4
65 X 100	5.8	9.1	7.1	7.3	7.9	8.0	6.5	7.7	4.3	8.2	5.1	4.7	6.6	4.2	5.0	4.6
100 X 200	5.1	6.3	6.3	7.4	6.5	6.4	6.4	4.4	12.1	10.7	8.4	8.1	5.4	10.6	8.4	6.1
-200	2.7	0.4	0.8	3.2	1.0	0.4	1.4	0.5	2.0	0.6	1.5	2.2	1.4	1.1	2.4	1.0
% Char	56.3	56.1	49.4	51.3	53.3	45.3	51.4	40.2	47.1	49.6	41.9		38.8	44.2	41.2	72.1
$Ash+SO_3$ in Char, Wt.%	24.01	21.46	22.12	19.41	17.78	18.88	14.92	15.84	15.40	14.66	19.42	17.25	16.36	18.41	18.85	5.92
Ash Analysis, Wt %																
SiO_2	22.10	22.26	26.80	23.98	20.76	26.13	21.84	25.31	22.23	22.31	22.54	22.17	20.01	22.42	23.06	19.98
SO_3	9.58	11.90	5.25	4.15	3.82	3.21	2.45	2.91	2.36	2.68	2.08	2.26	2.28	2.26	2.14	3.63
Na_2O	1.90	2.02	1.99	1.84	1.66	1.83	1.56	1.51	1.38	1.70	1.44	1.36	1.27	1.42	1.37	1.22

Table 19-19. REGENERATOR FUEL CHAR, RUN 21 (Sheet 1 of 2)

Date	9/8	9/8	9/8	9/9	9/9	9/9	9/10	9/10	9/10	9/11	9/11	9/11	9/12	9/12	9/12	9/13
Time	0000	0800	1600	0000	0800	1600	0000	0800	1600	0000	0800	1600	0000	0800	1600	0000
Screen Size, Wt % Tyler Mesh																
+6	1.6	3.2	1.9	1.5	1.4	2.4	2.2	2.8	2.6	3.2	2.1	2.4	2.1	2.5	2.5	2.1
6 X 8	8.1	14.5	12.2	8.8	11.1	16.8	13.8	14.9	12.6	15.8	11.0	12.3	12.2	13.0	14.1	11.8
8 X 10	13.3	17.7	14.3	15.2	15.8	16.6	19.7	16.0	13.9	16.2	14.3	13.8	15.8	14.5	15.0	15.3
10 X 14	6.6	6.6	6.9	8.6	6.7	7.4	9.9	6.7	5.6	7.4	5.8	5.9	7.4	6.3	6.6	8.2
14 X 20	10.8	9.0	10.7	13.1	9.6	10.4	12.2	9.4	9.0	11.0	9.4	10.2	11.7	10.4	10.5	13.0
20 X 28	17.0	13.1	15.0	18.3	15.5	15.7	15.8	15.2	16.7	17.2	17.4	19.2	19.2	19.6	19.3	22.8
28 X 35	17.9	13.9	15.3	17.1	16.7	14.8	13.8	15.3	17.2	15.2	16.0	17.9	16.7	16.9	16.5	16.7
35 X 48	9.7	7.2	8.0	8.1	8.0	6.7	5.8	7.1	8.3	6.7	7.9	7.7	6.9	6.9	6.4	5.2
48 X 65	3.9	3.9	2.7	3.8	Tr	2.2	0.3	3.4	2.8	1.1	3.2	2.6	2.6	3.6	2.3	1.7
65 X 100	10.5	8.4	10.3	5.5	12.6	6.5	5.8	7.2	9.7	6.4	9.9	7.5	5.5	5.5	5.9	3.2
100 X 200	0.6	2.5	2.7	Tr	2.6	0.6	0.5	1.9	1.6	Tr	3.0	0.6	Tr	0.8	0.9	Tr
-200																
% Char	45.9	42.3	47.5	37.8	35.7	36.0	38.2	32.1	39.3	38.1	34.2	37.3	36.3	35.0	36.3	
$Ash+SO_3$ in Char, Wt.%	15.91	15.60	14.50	12.18	15.21	11.61	13.02	12.50	10.33	14.18	12.96	14.74	12.45	10.73	10.25	8.56
Ash Analysis, Wt.%																
SiO_2	24.12	24.30	19.94	18.49	24.23	21.24	18.36	18.62	19.00	24.98	26.86	23.33	27.82	25.41	21.66	27.16
SO_3	2.50	2.46	1.93	1.87	2.06	2.38	2.36	2.22	1.68	1.77	1.24	1.90	2.35	1.84	2.54	2.79
Na_2O	1.48	1.30	1.29	1.11	1.42	1.46	1.30	1.24	1.04	1.11	1.37	1.11	1.37	1.25	1.14	1.47

Table 19-19. REGENERATOR FUEL CHAR, RUN 21 (Sheet 2 of 2)

	Daily Composites								
Date	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15	7/16
Time	0800	0800	0800	0400	0400	0400	0400	0400	0400
Screen Size, Wt %									
Tyler Mesh									
+60	1.2	0.5	1.8	7.1	8.6	0.7	0.3	Tr	0.1
60 X 100	0.4	0.4	12.3	15.0	24.6	5.5	1.4	2.2	3.2
100 X 325	6.7	21.0	60.0	47.8	42.2	53.6	36.2	33.4	47.5
-325	91.7	78.1	25.9	30.1	24.6	40.2	62.2	64.4	49.2
H_2O	0	0	0	0	0	2.24	0.87	0	0
C	50.72	45.57	50.01	45.78	45.96	64.46	55.44	57.19	56.41
H	2.41	1.02	2.08	2.01	3.72	1.88	2.36	2.55	1.57
S	2.10	1.88	1.22	0.92	0.66	0.66	0.60	0.66	0.89
Ash+SO3	32.16	45.58	40.37	25.24	33.55	26.15	29.48	32.16	32.09
Ash Analysis, Wt %									
SiO_2	23.92	21.85	27.16	28.49	32.36	30.42	29.18	24.33	20.71
SO_3	15.93	12.56	7.65	7.55	6.68	5.98	5.98	7.04	7.45
Na_2O	1.34	1.04	1.23	1.33	1.59	1.50	1.20	1.05	1.00
CaO	26.15	34.17	35.57	36.67	35.24	36.09	41.30	44.62	48.64
MgO	4.96	4.20	4.52	5.27	5.12	6.70	6.28	6.75	7.57
K_2O	0.17	0.08	0.13	0.21	0.26	0.35	0.32	0.27	0.24
P_2O_5	0.14	0.05	0.06	0.09	0.15	0.16	0.11	0.16	0.19
Al_2O_3	11.21	12.06	10.92	11.72	9.87	9.91	8.95	8.51	8.19
Fe_2O_3	16.51	15.14	12.40	7.59	7.90	6.82	6.34	6.20	6.08
TiO_2	0.53	0.60	0.62	0.55	0.49	0.37	0.34	0.36	0.43

Table 19-20. GASIFIER CHAR TO ORGANIC POND, RUN 19

	Daily Composites				
Date	8/14	8/15	8/16	8/17	8/18
Time	0400	0400	0430	0400	0400
Screen Size, Wt %					
Tyler Mesh					
+60	0.9	0.9	0.2	0.9	0.9
60 X 100	7.7	4.8	3.5	4.1	5.9
100 X 325	29.2	32.8	49.4	39.3	35.7
-325	62.2	61.5	46.9	35.7	57.5
H_2O	6.22				
C	57.15	61.66	63.89	63.42	62.76
H	1.77	1.94	1.54	1.47	1.86
Sulfur (Total)	0.99	0.85	0.74	0.56	1.17
Ash+SO_3	35.37	28.61	27.58	27.65	31.10
Ash Analysis, Wt %					
SiO_2	31.43	26.43	29.83	31.58	39.04
SO_3	9.58	8.76	6.93	5.82	13.17
Na_2O	1.30	1.35	1.54	1.48	1.13
CaO	33.30		36.67		
MgO	4.72		6.42		
K_2O	0.19		0.41		
P_2O_5	0.10		0.15		
Al_2O_3	9.20		9.41		
Fe_2O_3	10.29		8.49		
TiO_2	0.61		0.50		

Table 19-21. GASIFIER CHAR TO ORGANIC POND, RUN 20

	Daily Composites											
Date	9/2	9/3	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13
Time	0500	0500	0500	0400	0000	0000	0000	0000	0000	0000	0000	0000
Screen Size, Wt %												
Tyler Mesh												
+60	0.6	Tr	15.5	5.9	0.4	Tr	0.2	0.9	Tr	Tr	Tr	Tr
60 X 100	6.4	5.3	27.7	29.9	1.9	7.0	27.0	9.7	5.6	3.2	5.6	3.8
100 X 325	44.6	43.8	37.7	58.4	41.1	46.9	41.5	45.6	48.9	52.7	39.4	59.5
-325	48.4	50.8	19.2	5.8	56.7	46.1	31.3	43.8	45.4	44.1	55.0	36.6
H_2O					0	0	0	0	0	0	0	0
C	58.48	63.53	63.03	57.96	59.3	63.00	62.93	60.50	61.63	62.28	60.82	63.58
H	1.64	1.37	2.76	2.02	4.14	1.31	3.03	1.18	1.58	1.32	1.73	1.56
S (Total)	2.15	1.38	0.66	0.58	0.56	0.47	0.61	0.66	0.65	0.61	0.52	0.65
Ash+SO_3	33.18	29.79	28.07	27.09	25.10	28.65	28.14	29.54	27.67	28.61	27.84	26.46
Ash Analysis, Wt.%												
SiO_2	35.33	34.02	30.64	32.76	36.24	35.15	33.17	31.37	27.24	31.20	29.12	29.34
SO_3	16.71	10.80	6.37	5.21	5.19	4.23	4.78	4.60	6.36	5.56	4.51	6.75
Na_2O	1.21	1.67	1.32	1.42	1.67	1.47	1.43	1.29	1.19	1.22	1.11	1.04
CaO	21.78		35.17		35.29		35.98		42.17		37.92	
MgO	4.61		7.87		7.20		9.72		6.03		9.42	
K_2O	0.40		0.31		0.62		0.59		0.42		0.52	
P_2O_5	0.04		0.12		0.09		0.06		0.14		0.11	
Al_2O_3	10.79		10.76		9.13		10.40		8.82		10.35	
Fe_2O_3	11.83		5.30		4.98		5.44		5.13		5.17	
TiO_2	0.65		0.62		0.47		0.47		0.45		0.58	

Table 19-22. GASIFIER CHAR TO ORGANIC POND, RUN 21

Date	7/8	7/9	7/11	7/11	7/12	7/13	7/14	7/15	7/16
Time	1810	2030	0100	2130	2000	1830	2100	2100	0330
Screen Size, Wt %									
Tyler Mesh									
+35	1.6	2.6	0.7	0.5	3.1	0.8	1.1	0.3	0.4
35 X 48	6.0	6.4	6.1	3.8	7.4	5.2	6.1	2.8	2.3
48 X 65	13.9	12.1	13.8	8.1	13.0	8.3	10.7	6.7	6.9
65 X 100	19.6	16.0	20.1	15.1	15.5	11.6	14.9	12.2	12.5
100 X 200	19.6	20.1	22.4	25.9	21.3	21.1	19.5	22.7	23.0
200 X 325	9.2	11.4	10.3	15.3	10.1	18.3	12.9	15.8	16.5
-325	30.1	31.3	26.6	31.3	29.5	34.8	34.8	39.5	38.4
% Calcine Weight Change	-17.5	-7.5	-7.3	-6.0	-5.2	-2.5	-3.9	-1.1	-1.8
Elemental Analysis, Wt %									
SiO_2	29.93	30.49	30.80	30.96	32.06	26.44	25.89	22.71	20.09
SO_3	8.11	10.68	8.85	6.41	4.70	5.61	4.23	5.23	3.82
Na_2O	1.64	1.86	1.69	1.33	1.80	1.32	1.35	1.43	1.47
CaO	33.53	33.15	31.70	32.14	32.44	36.41	37.39	39.62	40.38
MgO	14.76	9.57	10.94	12.85	14.27	15.89	17.44	19.00	19.57
K_2O	0.22	0.27	0.33	0.24	0.78	0.81	0.89	0.54	0.73
P_2O_5	0.04	0.04	0.06	0.05	0.10	0.13	0.14	0.13	0.08
Al_2O_3	10.38	11.42	11.75	10.92	10.82	10.55	9.90	8.56	11.16
Fe_2O_3	3.55	2.99	3.67	4.84	3.18	3.24	3.19	2.89	2.98
TiO_2	0.27	0.55	0.43	0.40	0.30	0.38	0.51	0.31	0.29

Table 19-23. ASH AND ATTRITED ACCEPTOR ANALYSIS, RUN 19

Date	8/13	8/14	8/15	8/16	8/17
Time	0430	0400	0430	0930	0300
Screen Size, Wt %					
Tyler Mesh					
+35	1.3	1.9	1.0	5.1	1.2
35 X 48	5.5	9.0	6.8	2.7	4.5
48 X 65	11.1	14.8	11.6	6.0	7.7
65 X 100	17.3	17.6	14.9	9.8	10.9
100 X 200	25.9	20.4	22.5	22.5	21.1
200 X 325	11.6	9.8	13.4	17.1	17.0
-325	27.4	26.5	29.8	36.9	37.5
% Calcine Weight Change	-7.96	-14.96	-3.98	-3.88	-3.30
SiO_2	32.86	31.36	26.83	23.10	23.60
SO_3	6.46	4.76	2.90	2.50	2.69
Na_2O	1.58	1.80	2.00	1.36	1.18
CaO		35.85		41.79	
MgO		14.65		19.42	
K_2O		0.57		0.64	
P_2O_5		0.09		0.11	
Al_2O_3		6.10		6.68	
Fe_2O_3		3.54		3.57	
TiO_2		0.45		0.36	

Table 19-24. ASH AND ATTRITED ACCEPTOR ANALYSIS, RUN 20

Date	9/2	9/3	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12
Time	1330	1200	1030	1000	1115	0900	0940	0900	0940	1035	1100
Screen Size, Wt %											
Tyler Mesh											
+35	54.3	3.3	2.0	0.9	0.8	0.4	0.3	0.8	0.5	1.7	1.2
35 X 48	13.2	7.3	6.1	5.0	4.8	2.9	3.0	3.4	3.1	2.8	4.0
48 X 65	13.5	13.9	10.0	8.9	8.3	6.9	6.4	7.0	6.6	5.5	7.4
65 X 100	8.4	18.2	14.7	13.4	12.7	11.1	10.4	11.2	10.7	8.5	11.4
100 X 200	4.3	21.4	22.7	21.5	21.1	21.7	21.4	20.6	20.7	16.1	20.7
200 X 325	1.6	10.1	14.6	15.1	15.8	16.3	17.7	18.6	26.2	14.6	20.3
-325	4.7	25.7	30.0	35.2	36.5	40.6	40.8	38.4	32.2	50.8	35.1
% Calcine Weight Change	-6.1	-9.2	-2.8	-4.7	-4.2	-2.7	-2.9	-3.2	-3.2	-2.7	-2.2
SiO_2	10.61	38.72	29.69	30.42	28.14	25.21	25.77	28.59	20.65	28.50	25.39
SO_3	6.85	4.87	2.78	4.20	4.88	3.83	2.66	2.57	3.10	1.72	2.89
Na_2O	0.46	1.72	1.47	1.23	1.40	1.06	0.98	0.98	1.09	0.79	0.75
CaO	47.68		37.17		36.12		40.46		41.81		40.48
MgO	27.52		14.54		14.43		15.88		18.16		17.02
K_2O	0.15		0.79		0.71		0.67		0.75		1.54
P_2O_5	0.03		0.11		0.12		0.16		0.08		0.08
Al_2O_3	5.01		10.04		10.56		10.00		11.05		9.39
Fe_2O_3	1.51		3.25		3.08		3.01		3.01		2.58
TiO_2	Tr		0.18		0.40		0.18		0.19		0.10

Table 19-25. ASH AND ATTRITED ACCEPTOR ANALYSIS, RUN 21

	Lignite Feed Line	Gasifier Boot Cone	Regenerator Bottom
	Wt %	Wt %	Wt %
Ultimate Analysis			
H_2O	.70	0.01	
Carbon		2.26	
Hydrogen		0.50	
Sulfur (Total)		0.23	
Ash+SO_3	46.57	95.86	
Elemental Analysis			
SiO_2	1.96	16.95	24.91
SO_3	2.62	0.69	0.71
Na_2O	0.04	0.34	0.63
CaO	54.44	45.86	44.46
MgO	37.53	30.29	25.83
K_2O	0.02	0.23	0.39
P_2O_5	0.01	0.39	0.08
Al_2O_3	0.90	3.21	0.14
Fe_2O_3	2.46	1.86	2.22
TiO_2	0.11	0.13	0.16

Table 19-26. DEPOSITS FORMED DURING OPERATION, RUN 19

Screen Size, Wt % Tyler Mesh	
+6	0.0
6 X 8	0.2
8 X 10	11.3
10 X 14	68.2
14 X 20	15.9
20 X 28	1.4
28 X 35	0.6
35 X 48	0.6
48 X 65	0.3
65 X 100	0.04
100 X 200	0.8
Pan	0.8

Size Fraction	+10	10 X 14	14 X 20	20 X 28	28 X 35	35 X 48	48 X 65	100 X 200
Muffle Weight Change %	-8.0	-5.1	-7.1	-9.5	-10.4	-10.4	-10.72	
Sulfide, Wt %	0.02	0.01	0.02	0.03	0.02	0.04	0.06	0.06
SiO_2	2.10	1.38	2.82	9.55	18.74	25.25	37.25	34.12
SO_3	0.02	0.03	0.03	0.06	0.08	0.27	0.46	1.00
Na_2O	0.02	0.02	0.04	0.12	0.17	0.40	0.48	0.50
CaO	54.07	54.67	54.21	48.82	44.09	37.41	28.61	34.94
MgO	37.21	37.60	37.82	35.58	29.86	23.67	16.13	16.77
K_2O	0.01	0.01	0.02	0.07	0.07	0.20	0.28	0.22
P_2O_5	0.02	0.02	0.02	0.04	0.06	0.08	0.24	0.41
Al_2O_3	1.37	1.52	1.67	2.78	2.50	4.51	5.99	6.14
Fe_2O_3	1.15	1.16	1.42	1.88	2.25	5.01	9.23	6.67
TiO_2	0.07	0.05	0.08	0.13	0.20	0.35	1.07	0.47

Table 19-27. ANALYSIS OF GASIFIER BOOT DEPOSIT, RUN 21

RUNS 22 AND 23

SEPTEMBER 20, 1974 TO FEBRUARY 5, 1975

CO_2 ACCEPTOR PROCESS GASIFICATION

PILOT PLANT

RAPID CITY, SOUTH DAKOTA

1 SUMMARY

This report covers the Rapid City Pilot Plant operations for Runs 22A (September 20-27, 1974), 22B (November 22-30, 1974), 22C (December 13-22, 1974), and 23 (January 7-February 5, 1975).

Run 21 was of sufficient length that the accumulation of foreign material (intermediate fines) in the system became a recognizable problem. The intermediate fines were derived principally from small amounts of silica sand and clay constituents in the lignite and char feedstocks. In the gasifier, the foot fluidizing velocity was high enough to strip most particles which were typically -20 Tyler mesh from the recarbonated acceptor. Therefore, fines could not be removed with the spent acceptor which was purged to the dump hopper, F-213, nor could the fines be stripped from the regenerator acceptor or the gasifier char beds, since the fluidizing velocities were too low for elutriation. The particles would circulate between reactors through the fuel char line and the calcined acceptor standleg, but the particles could not be purged from the system.

Following Run 21, plans were made to install a char removal system which would control the concentration of the intermediate fines. Since a long plant shutdown was required for the installation of the new equipment, a short duration run, Run 22A, was attempted. The run had the limited objective of demonstrating plant operability using pure steam as the gasifier boot fluidizing medium. However, due to the hurried charge out of the recycle gas for steam, the char acceptor interface was lost and the plant had to be shut down.

Following Run 22A, a long plant turnaround which lasted eight weeks was scheduled. The major plant changes made during the period included: (1) replacement of the regenerator refractory; (2) modification of the gasifier quench system; (3) modification of the calcined acceptor standleg; (4) installation of the char removal system; and (5) the installation of an additional regenerator cyclone. Runs 22B, 22C, and 23 were then conducted. These runs failed to achieve the objective of demonstrating integrated plant operation for a period of thirty days. However, the runs were successful in that they provided: (1) additional acceptor circulation data; (2) demonstrated the operability of the new plant equipment; (3) demonstrated plant operability using 70 to 75 percent steam for the boot fluidizing gas; and (4) provided information on the source and control of intermediate fines.

2 TEST DATA

Runs 22 and 23 data are presented graphically and/or tabularly at the end of this run report. The figures and tables include:

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3 SIGNIFICANT EVENTS AND OBSERVATIONS

3.1 HISTORY OF RUNS 22A, 22B, 22C, AND 23

3.1.1 Objectives

Run 22A

This run was to have the limited objective of demonstrating plant operability using pure steam to fluidize the collected acceptor in the gasifier boot.

Runs 22B, 22C, and 23

For these runs the objectives were:

(1) To achieve long-term, integrated plant operation, preferably for a thirty day period.

(2) To demonstrate plant operation using pure steam to fluidize the gasifier boot acceptor.

(3) To establish balance periods in which the effects of process variables such as the gasifier and regenerator temperatures, acceptor makeup rate, gasifier inlet steam flow, and gasifier steam partial pressure could be studied.

3.1.2 Accomplishments

Run 22A

Operated plant for approximately 45 minutes using pure steam to fluidize the gasifier boot acceptor.

Run 22B

(1) Demonstrated operability of new equipment including the char removal system, the modified gasifier quench system, and the new gasifier boot flow gas distributor.

(2) Established a base set of operating conditions using computer simulation model to predict plant response to input variables.

Run 22C

(1) Accumulated extensive acceptor circulation data and modified existing lift line pressure drop correlations to more accurately predict the acceptor transfer rates between reactors.

(2) Achieved a base case balance period in which reactors were held at operating temperature, dead-burned dolomite was circulated, and Velva lignite was used as gasifier feedstock.

(3) Operated gasifier without the need for air addition to maintain char bed temperatures of 1490° to 1500°F.

Run 23

(1) Demonstrated gasifier operation with boot flow of 70 to 75 percent steam.

(2) Demonstrated that high gasifier boot fluidizing gas flows improved the control of the char-acceptor interface and greatly reduced the chances of the acceptor bridging in the boot.

(3) Operated gasifier without the need of supplemental air.

(4) Investigated sources of intermediate fines and developed techniques for monitoring the presence of this "junk" material in the system.

3.1.3 Termination Causes

Run 22A

The step change approach taken for replacement of the gasifier boot recycle gas with steam resulted in low boot fluidizing gas flows which caused the loss of the char-acceptor interface and the plugging of the recarbonated acceptor standleg, CD-204.

Run 22B

Expansion joint, EJ-4, on the gasifier side flow line, CO-203, developed a leak. The leak was probably caused by the momentary system overpressuring to 220 PSI which occurred when the level controller on the gasifier quench tower, E-301 froze. The tower flooded and water carried through the recycle compressors, J-201 A and B, and to the flare headers.

Run 22C

The acceptor lift line plugged and could not be cleared. The blockage resulted from low gasifier boot flow which caused the boot acceptor to bridge and allowed the recarbonated acceptor standleg to drain. Loss of the standleg seal resulted in the venting of acceptor lift gas to the gasifier and the filling of the lift line, CD-208, with solids.

Run 23

A large, high temperature area developed on the external pressure containing jacket of the acceptor lift line, CD-208, due to the erosion of the inner Incoloy 800 sleeve.

3.1.4 Mechanical problems

Run 22A

(1) During an initial startup attempt, the line between the gasifier and the spent dolomite dump hopper, F-213 plugged. The system was depressured in order to clear the line.

(2) When the lignite grinding system was first started up, air leaks into the system caused burning of several filter bags in the baghouse, L-112. All bags were replaced and the system oxygen level was more closely monitored to eliminate such future occurrences.

(3) During an early startup attempt, expansion joint, EJ-15, on the acceptor lift line, CD-208, was found to be leaking. The unit was replaced with an expansion bellows made of solution-annealed Incoloy 825.

(4) Fuel char feed to the regenerator was at times difficult to maintain due to system pressure swings.

Run 22B

(1) Plant air compressor, J-202, shut down several times due to a loose mercury switch.

(2) Due to erosion, a small one-inch diameter hole developed in the slip joint on the inner liner of the regenerator fuel char transfer line, CO-204.

(3) The regenerator fuel char transfer was lost many times due to leaks in the new char removal system and the difficulty in determining the proper purge gas flows to the new lockhoppers, F-215 and F-216.

Run 22C

(1) Following the run, the shaft on the fuel char flow control valve, LCV-2002, was found to be twisted and was replaced. The twisted shaft explained the need to operate the valve in a more than normal open position.

(2) The plant boiler shut down unexpectedly several times requiring the cessation of lignite feed to the gasifier.

(3) Severe erosion occurred in the acceptor lift line block valve, XCV-2010, and in the regenerator lift line nozzle.

Run 23

(1) During the first startup attempt, a plug of agglomerated dead-burned dolomite and char ash formed in the calcined acceptor standleg, CD-206. The clinker-like material was caused by the reuse of dead-burned dolomite which has previously been withdrawn from the system. The small amount of char, which was contained in the dolomite, burned and sintered when air was admitted to the regenerator to help fluidize the acceptor inventory during the initial filling of the system.

(2) Natural gas curtailment during a spell of extremely cold weather forced a plant shutdown after the system had been heated but before solids were admitted.

(3) The casting which supports the shaft on which the lignite grinding mill rollers are attached broke and was replaced with a forged steel unit.

(4) The drive for the blow ring carriage in the lignite grinding system baghouse jammed. A worn out gear was replaced.

3.1.5 Process Problems

(1) During all runs small deposits of dead-burned dolomite formed in the gasifier boot.

(2) What appeared to be agglomerated char fines formed deposits in the gasifier quench tower, E-301, and caused plugs between the quench tower and the flash pot, F-324, and between the flash pot and the organic waste pond.

3.2 CHRONOLOGY OF OPERATIONS

3.2.1 Run 22A

Date	Time	Hours Counting	Description
9/20	1515		Started pressuring up.
"	1625		System up to pressure. Started static pressure test to determine leak rate.

Date	Time	Hours Counting	Description
9/20	1848		Started depressuring system to repair leaks.
9/21	1730		Pressuring up system.
"	1830		Started static pressure test.
"	1937		Static pressure test finished.
"	1945		Started J-309, recycle CO_2 compressor.
"	2010		Started all recycle gas compressors.
"	2040		"A" recycle gas dryers put on line.
"	2300		"B" recycle gas dryers put on line.
9/22	1130		Initiated shutdown procedures due to leak at S-9 sample station.
"	1300		System depressured.
"	1600		Pressuring up system.
"	1615		J-309, recycle CO_2 compressor, was placed on line.
"	1645		recycle gas compressors started.
"	1720		"A" and "B" recycle gas dryers placed on line.
"	1740		Heaters fired.
"	2230		Began 700°F hold on reactors for refractory cure
9/23	0820		Reactors up to operating temperature.
"	0915		Started dead-burned dolomite feed to gasifier via F-204A, lignite feed lockhopper. Unable to withdraw dolomite to F-213, purge dolomite lockhopper.
"	1545		Started up 100 area grinding.
"	1555		Started shutdown procedures to clear F-213.
"	1810		Shut down 100 area grinding. NOTE: The filter bags inside L-112, baghouse, were found to be burned up.
"	2100		System depressured.
9/24	0015		Pressuring up system.
"	0150		Started heaters and recycle compressors.
"	0230		System up to pressure.
"	0300		"A" and "B" recycle gas dryers placed on line.
"	0910		Boiler shut down for maintenance.
"	0925		Started dead-burned dolomite addition to gasifier via F-204A, lignite feed lockhopper.
"	1000		Transferred acceptor from gasifier to regenerator.
"	1030		Started dead-burned dolomite addition to generator via F-206, dolomite feed lockhopper.
"	1045		"B" gas dryer taken off line for maintenance.
"	1245		Boiler started back up.
"	1400		"B" gas dryer back on line.
"	1908		Calcined acceptor standleg seal established.
"	1920		Began solids circulation.
"	1940		Air introduced into regenerator to expand bed.
"	2010		Started solids circulation test.

Date	Time	Hours Counting	Description
9/24	2115		Solids circulation test finished. Started gas circulation tests.
"	2238		Gas circulation tests finished.
"	2241		Started removing air from regenerator.
"	2300		Air out of regenerator.
"	2325		Steam added to side of gasifier. Recycle gas removed from gasifier side.
9/25	0030		Began char addition to gasifier via F-204A, lignite lockhopper. Zinc oxide system placed on line.
"	0518		Air introduced into gasifier.
"	0600		Acceptor circulation started.
"	0945		Steam introduced into gasifier boot.
"	1230		Began decreasing B-203 and B-204 heaters to 800°F.
"	1415		J-201B, gasifier recycle gas compressor was taken off line.
"	1830		Good char transfer to regenerator started. NOTE: Trouble starting char transfer to regenerator experienced.
"	2045	0	Reached 1800°F in regenerator.
"	2125		Gasifier at 1511°F.
"	2128		Started lignite addition to gasifier via F-204A, lignite feed lockhopper.
"	2025		Fuel char transfer lost. Methane added to regenerator to hold temperature.
9/26	0905		Char transfer regained. Methane out of system.
"	1020		Fuel char transfer lost. Methane fed to regenerator.
"	1115		Char transfer regained. Methane addition to regenerator discontinued.
"	1150	0	Regenerator at 1800°F.
"	1215		Increasing dolomite circulation.
"	1325		J-201B, gasifier recycle gas compressor started. J-201A, gasifier recycle gas compressor shut down.
"	1415		Zinc oxide system taken off the system. Recycle gas to boot of gasifier being replaced with steam.
"	1520		Gasifier boot flow is total steam.
"	1540		Gasifier boot flow routed through "C" convection section of B-201 heaters.
"	1730		Upset in boot of gasifier. Acceptor transfer lost.

Date	Time	Hours Counting	Description
9/26			NOTE: Dolomite and lignite feed stopped. Methane added to regenerator. Steam to boot of gasifier replaced with recycle gas. Attempted to regain bed and establish acceptor circulation.
"	2000		Started dumping gasifier contents to F-213, purge dolomite lockhopper.
9/27	0300		Dolomite makeup to regenerator started.
"	0350		Gasifier empty.
"	0428		Started transferring dead-burned dolomite to gasifier.
"	0445		Dolomite level in gasifier established.
"	0500		Unable to transfer through recarbonated acceptor standleg, CD-204.
"	0945		Initiated shutdown procedures.
"	1500		System depressured.

3.2.2 Run 22B

11/22	1630		Started pressuring system with air through "A" and "B" gas dryers.
"	1830		Depressuring system to repair leaks.
"	2136		Pressuring system up. Stroked all solids valves.
11/23	0345		Depressuring unit again to repair leaks.
"	0800		System depressured.
"	1045		Pressuring unit back up.
"	1505		System at 150 PSIG.
"	1535		Began static test to determine leak rate.
"	1850		Static test finished. J-309, recycle CO_2 compressor, and system recycle gas compressors started.
"	1910		Gas flows established.
"	1930		Heaters lit.
11/24	0855		Checked solids valves, sample points and dump hoppers.
11/25	0500		Refractory cure finished, proceeding with vessel heatup.
"	1530		Started dead-burned dolomite feed to gasifier.
"	1600		Dumped to F-213, purge dolomite lockhopper for 5 minutes to insure system integrity.
"	1645		Started dead-burned dolomite feed to regenerator via L-204, fresh dolomite rotary feeder.
"	2215		Established gas seal between reactors with the filling of the calcined acceptor standleg, CD-206.
"	2320		L-204, fresh dolomite rotary feeder, shut off. Air added to regenerator to expand bed.

Date	Time	Hours Counting	Description
11/26	0040		Began dolomite circulation.
"	0230		Started gas circulation tests.
"	0500		Finished gas circulation tests.
"	0530		Started solids circulation test.
"	0715		Finished solids circulation tests.
"	1022		Solids circulation stopped.
"	1120		Steam introduced into gasifier side. Recycle removed from gasifier side.
"	1158		Began char feed to gasifier.
"	1255		Started acceptor circulation.
"	1555		Air introduced into gasifier side.
"	2045		Attempted to transfer char.
11/27	1200		Finally gained fuel char transfer.
"	1555		Fuel char transfer lost for 15 minutes.
"	1935		Began withdrawing to F-215, char removal hopper.
"	1950		Shut down J-207B, devolatilizer recycle gas compressor.
"	1955	0	Regenerator at 1800°F. Found the recycle gas block valve was leaking gas to gasifier side heaters.
"	2210		Steam added to gasifier boot.
"	2315		Fuel char transfer shaky.
"	2330		F-215, char removal lockhopper taken off line and lockhopper F-216 placed on line. J-201B, gasifier gas recycle compressor placed on standby. Fuel char transfer lost.
11/28	0930		Fuel char transfer regained.
"	1230		Regenerator at 1800°F again
"	1640		Char removal system isolated.
"	1655		Fuel char transfer lost.
"	2030		Fuel char transfer regained.
"	2320		Increasing acceptor circulation.
11/29	0100		Small upset when plug in calcined acceptor flow control valve, TCV-2030 broke loose.
"	0330		Acceptor circulation at 11,000 LBS/HR.
"	0430		F-215, char removal lockhopper placed on line for test run.
"	0840		Fuel char transfer lost.
"	0855		Fuel char transfer regained.
"	0955		F-215 taken off line and emptied.
"	1035		F-215 placed back on line.
"	1045	38.8	Lignite feed started to gasifier.
"	1145		Fuel char transfer lost.
"	1150		Fuel char transfer regained.
"	1200		Fuel char transfer lost.

Date	Time	Hours Counting	Description
11/29	1205		Fuel char transfer regained.
"	1220		F-215 taken off line.
"	1230		Second stage relief valve on J-202, main air compressor, reset.
"	1255		J-202 suddenly shut down with no alarm.
"	1315		J-202 back on line.
"	1345		J-202 shut down.
"	1355		J-202 on line.
"	1410		J-202 shut down.
"	1420		J-202 on line. NOTE: Found that mercury switch on oil pressure line loose.
"	1500		Amperage load on J-202 high. Reduced discharge pressure to lower amperage reading.
"	1727		J-207B, devolatilizer recycle compressor, placed on standby.
"	1740		F-215 placed on line.
"	1915		J-201B, gasifier recycle compressor, placed on standby.
"	1935		F-215 taken off line.
"	2002		Fuel char transfer lost.
"	2040		F-215 placed on line.
"	2240	50.75	Low level in gasifier quench tower, E-301, followed by high level.
"	2245		System over pressuring and interface lost. Water pumped through gasifier compressor, J-201A. NOTE: E-301 filled with water which flooded the gasifier system.
"	2300	51.1	Lignite feed to gasifier shut off.
"	2315		J-207B, devolatilizer recycle compressor, started.
"	2330		System pressure back to normal. Air out of regenerator and gasifier. Acceptor and fuel char transfer lost.
11/30	0010		Steam removal from gasifier boot. Gasifier compressor, J-201B, drained of water. Attempting to withdraw to J-213.
"	0020-0715		Attempted to dump to F-213 and transfer acceptor to regenerator. Batch transfer only in both lines. dPR's freezing up due to water in sensing lines.
"	0730		Leak found in expansion joint, EJ-4. Shutting system down.
"	1000		Gasifier empty of material.
"	1215		All compressors shut down.
"	1400		System depressured.

3.2.3 Run 22C

Date	Time	Hours Counting	Description
12/13	1230		Started pressuring up system with air.
"	1430		System at 150 PSIG.
"	1615		Started static pressure test.
"	2005		Static pressure test finished. Heaters lit.
12/14	0420		J-309, recycle CO_2 compressor, placed on line.
"	0830		Recycle compressors started.
"	0900		Recycle gas dryers placed on line.
"	1330		Started refractory cure. Gasifier temperature at 250°F.
"	1515		J-309 compressor taken off line for maintenance.
"	1715		J-309 compressor back on line.
"	1845		All solids valves stroked.
12/15	0630		Gasifier temperature at 700°F.
"	1030		Started increasing heater temperatures.
"	1750		All solids valves stroked.
"	2048		Began addition of dead-burned dolomite to gasifier.
12/16	0042		Transferred first batch of dead-burned dolomite to the regenerator.
"	0100		Dumped to F-213, purged dolomite lockhopper.
"	0126		Started feeding dead-burned dolomite to the regenerator from F-206, dolomite feed lockhopper.
"	0810		Started dolomite circulation. Air introduced into the regenerator to expand bed.
"	0915		J-203A, recycle flue gas compressor, taken off line for maintenance.
"	0930		Air introduced into the gasifier.
"	1015		Started solids circulation test.
"	1045		Ended solids circulation test. Started lift line gas flow test.
"	1145		J-203A back on line.
"	1230		Lift line gas flow tests completed.
"	1240		Started dolomite circulation. NOTE: UAD-206 line between gasifier and F-213 dump hopper found bent. Maintenance allowed F-213 to shift relieving some of the tension on the line.
"	1530		Started solids circulation test.
"	2141		Finished solids circulation test. Air removed from the gasifier. Zinc oxide unit placed on line.
"	2210		Started dead-burned dolomite makeup to the system.
"	2320		Steam introduced into the gasifier side flow. Started removing the recycle gas to the gasifier boot.

Date	Time	Hours Counting	Description
12/16	2335		Dolomite circulation stopped to allow establishment of char bed.
12/17	0024		Started feeding char to the gasifier.
"	0225		Started dolomite circulation.
"	0352		Started adding air to the gasifier side.
"	0510		Char feed lost to gasifier.
"	0546		Char feed back.
"	0715		Started lowering regenerator heater temperatures.
"	1645		Fuel char transfer to the regenerator started. NOTE: Fuel char transfer was hard to start. Transfer line seems to be partially blocked.
"	1650		Dead-burned dolomite makeup feed stopped.
"	1830		Dead-burned dolomite makeup resumed.
12/18	0300		Worked on improving fuel char transfer. High valve air loading needed for decent transfer.
"	0345		Steam introduced to gasifier boot. Began increasing gasifier boot heater temperatures.
"	0455		J-207 A and B, devolatilizer recycle gas compressors, taken off line.
"	0615		Fuel char transfer lost. NOTE: Transfer lost while attempting to place F-215, char removal lockhopper, on line.
"	0830		Fuel char transfer regained.
"	0900		F-215, char removal lockhopper, place on line.
"	1000	0	Regenerator at 1800°F.
"	1215		F-216, char removal lockhopper, placed on line and F-215 lockhopper taken off line.
"	1445	4.75	Lignite feed started to the gasifier.
"	2030		F-215 placed on line. F-216 removed from service.
"	2200		Fuel char transfer lost. NOTE: Began experiencing trouble with char transfer after F-215 was placed on line. F-215 removed from service.
"	2340		Char transfer resumed.
12/19	0420		F-216 placed in service.
"	0515	19.25	Reached conditions for the first balance period.
"	1410		Lowered lift gas flow to 55,000 SCFH. Began replacing recycle gas to the gasifier boot with steam.
"	1630	30.5	F-215 placed on line. F-216 taken out of service.
"	1750		Recharged F-206, fresh dolomite feed lockhopper, with fresh 6 X 9 dolomite.

Date	Time	Hours Counting	Description
12/20	0200	40	F-216 placed on line. F-215 taken off line.
"	0345		Started removing air from the gasifier side flow. Began replacing the recycle gas to the gasifier boot flow with steam.
"	0655		Recycle flue gas flow to the regenerator air ring removed.
"	0750		Fuel char transfer lost.
"	0815	46.25	Fresh dolomite makeup stopped.
"	0824		Boiler shutdown occurred due to low water level.
"	0835		Lignite feed to the gasifier stopped. Boiler restarted. Steam removed from the gasifier boot and side flows, and replaced with recycle gas.
"	0900		Boiler shut down again.
"	0905		Boiler relit.
"	0908		Steam reintroduced into the gasifier boot and side flows. Dolomite circulation reduced.
"	0920		Fuel char transfer recovered. Char transfer very poor. Recycle gas removed from the gasifier side flow. Air introduced into the gasifier side flow.
"	1000		Char feed to the gasifier started.
"	1010		Char transfer to the regenerator improving.
"	1315		Reestablished lignite feed to the gasifier.
"	1351		Resumed fresh dolomite makeup.
"	1425		F-215 placed on line. F-216 taken off line.
"	1446		Recycle flue gas to regenerator air ring again discontinued. Dolomite circulation raised.
"	1845		Air removed from gasifier.
12/21	0215		F-216 on line. F-215 taken off line.
"	0220		Upset in gasifier. Lost seals on solids transfer lines. Acceptor lift line plugged.
"	0545		Started emptying gasifier contents into F-213.
"	1230		Gasifier empty.
"	1240		Added dead-burned dolomite to gasifier.
"	1325		Air added to regenerator through FRC-2113. Attempted to clear lift line without success.
"	1428		Started emptying gasifier.
"	1500		Depressuring system.
"	1535		Gasifier empty.
"	1545		All recycle compressors shutdown.
"	1650		System depressured.
"	1900		Regenerator empty.
"	2000		Pressuring system up.
"	2100		Recycle compressors started. Began circulating gas to cool down system.

Date	Time	Hours Counting	Description
12/22	1630		Started depressuring system.
"	1830		System depressured.

3.2.4 Run 23

1/7	1500		Pressuring up plant.
"	1635		System at 150 PSIG. Started static pressure leak test.
"	1910		Static pressure test finished. J-309, CO_2 recycle compressor, started.
"	2000		Started gas circulation tests.
"	2025		Heaters lit.
"	2145		A and B gas dryers in service.
"	2400		Gas circulation tests finished. Regenerator at 250°F. Starting two-hour hold.
1/8	0815		Holding reactor temperatures while running a leak test.
"	1015		Leak test finished, continuing with the reactor heatup.
"	1225		Regenerator at 700°F. Starting two-hour hold to cure refractory.
"	1425		Refractory cure finished. Beginning to raise reactor temperatures.
"	1625		ZnO towers placed on line.
"	2315		Started filling gasifier with dead-burned dolomite via F-204A, lignite feed lockhopper.
1/9	0100		Started feeding dead-burned dolomite to the regenerator via F-206, dolomite feed lock-hopper.
"	0800		Stopped feeding dead-burned dolomite from F-206.
"	0830		Started solids circulation. NOTE: Circulation very unstable.
"	0900		Solids circulation through TCV-2030 lost.
"	1931		Started lowering heater temperatures.
"	2130		ZnO towers taken out of service. System pressure lost momentarily. dPRC-2030 placed on manual and control regained.
"	2230		Heaters placed on pilot.
1/10	0135		Lift line plugged while attempting to transfer solids.
"	0430		Plant depressured to remove plug in calcined acceptor standleg, CD-206.
"	1614		Pressuring up system.
"	1840		System pressure at 150 PSIG.
"	2045		Recycle compressors started. "A" gas dryers placed in service.

Date	Time	Hours Counting	Description
1/10	2130		Heaters lit. Gas circulation started.
1/11	0415		Starting to depressure due to a leak. Compressors shut down. Heaters shut down.
"	0555		Pressuring up system. Heaters lit. Recycle compressors started.
"	0700		"A" and "B" gas dryers placed in service.
"	1200		ZnO towers placed on line.
"	1220		Shutdown procedure initiated due to a natural gas curtailment.
"	1400		System depressured.
1/14	0900		Pressuring up system.
"	1010		System at 150 PSIG.
"	1040		Recycle compressors started.
"	1130		Started gas circulation. Heaters lit. "A" gas dryer placed in service.
"	1230		Gas circulation through FCV-2014 and FCV-2260 very poor.
"	1255		"B" gas dryer placed in service.
"	1315		Lift line plugged. Initiated shutdown procedures.
"	1420		System depressured.
"	1700		Blew the regenerator ring with air and cleared lines CO-202, CO-204, and CD-204.
"	1815		Pressuring up system.
"	1955		Recycle compressors started. Gas circulation initiated.
"	2015		"A" and "B" gas dryers placed in service.
"	2035		System at 150 PSIG.
"	2100		Started leak test.
"	2153		Leak test finished.
"	2250		Heaters lit.
1/15	0830		Solids valves stroked. NOTE: Temporarily plugged the lift line. Solids were removed through F-213, purged dolomite lockhopper.
"	1100		ZnO unit placed on line.
"	1555		Feeding dead-burned dolomite to the gasifier via F-204A.
"	1705		Feeding dead-burned dolomite to the regenerator via F-206.
"	2315		Transferred dead-burned dolomite to the gasifier from regenerator.
"	2335		Started circulating solids.
"	2345		Solids circulation stopped.
1/16	0155		Started losing system pressure. NOTE: A leak, ice and water, found in the FI-2301 purge lines.

Date	Time	Hours Counting	Description
1/16	0645		Started solids circulation. NOTE: Gas flow tests were run earlier, however, poor data was obtained due to upset.
"	0845		Started dead-burned dolomite makeup to the regenerator.
"	1110		Solids circulation stopped. Dead-burned dolomite makeup stopped. Started gas flow tests.
"	1250		Gas flow tests finished.
"	1255		Started circulating solids.
"	1331		Started solids circulation tests.
"	1510		Finished solids circulation tests.
"	1530		Introduced steam to the gasifier side.
"	1745		Started feeding char to the gasifier via F-204A.
"	1900		Started dead-burned dolomite circulation.
"	2100		Started lowering B-203 and B-204 heater temperatures.
"	2110		Air introduced into the gasifier side.
"	2200		Air introduced into the regenerator.
"	2335		Placed the char removal system into service.
"	2345		Fuel char transfer to the regenerator started.
1/17	0005		Fuel char transfer lost.
"	0045		Fuel char transfer regained.
"	0150		Fuel char transfer lost.
"	0205		Fuel char transfer regained.
"	0330	0	Regenerator at 1800°F.
"	0340		Introduced steam into the gasifier boot. Raising boot heater temperatures.
"	0455		Char removal system plugged. NOTE: Blew out plug without losing char transfer.
"	1100		Dead-burned dolomite circulation through recarbonated acceptor flow control valve, LCV-2003, poor. Fuel char transfer lost.
"	1215		Dead-burned dolomite circulation back.
"	1345		Fuel char transfer back.
"	2000		Lignite feed to gasifier via F-204A started
"	2045		Fuel char transfer lost and regained. NOTE: Bottom drain valve on F-216, char removal lockhopper, leaking.
"	2400		Fuel char transfer to F-215, char removal lockhopper, lost without explanation.
1/18	0350	24.33	Fuel char transfer to F-215 regained.

Date	Time	Hours Counting	Description
1/18	1630		Fuel char transfer to the regenerator lost. NOTE: Loss caused while equalizing F-216 vessel with F-215 vessel.
"	1745		Fuel char transfer regained.
"	1830		J-201A, gasifier recycle gas compressor, shut down and placed on standby.
"	2030		Fresh 6 X 9 dolomite introduced into the system.
1/19	0300	47.5	Decreased the air to the gasifier side flow.
"	1135		The automatic differential control valve, for dPRC-2102, on the char removal line was switched to purging instead of venting.
"	1300		CO_2 introduced into the gasifier boot.
"	1400		Gasifier boot level controller placed on manual for 15 minutes due to slight upset.
"	1433		Replacing recycle gas to the boot with steam slowly. Continuing to decrease the air to the gasifier as temperature permits.
"	2220		Excess flue gas routed to the preheater.
1/20	0310		Increased dolomite circulation and lowered the gasifier boot flow slightly.
"	0430	73	Air out of the gasifier side.
"	0435		Gasifier air blocked in.
"	0835		Dolomite circulation cut and gasifier boot flow increased.
"	1115		Increasing steam to the gasifier side.
"	1405		Increased steam to the gasifier boot. Cut recycle gas to the gasifier boot and steam to the gasifier side.
"	1520		Continued adjusting gasifier flows.
"	2115		F-324, gasifier quench tower stripper tank, plugged in drain to the pond. NOTE: The line plugged after flushing E-301, gasifier quench tower.
"	2340		Quench system back to normal.
"	0100-0500	97.5	Continued adjusting gasifier flows, increasing the boot steam and decreasing boot recycle and side steam.
"	0720		Gasifier quench system plugged again. NOTE: Plug developed at the outlet nozzle of E-301.
"	0835		Fuel char transfer lost while switching the char removal hoppers.

Date	Time	Hours Counting	Description
1/21	0855		Flue gas removed from the preheater.
"	0910		Fuel char transfer regained.
"	0918		Air introduced into the gasifier side.
"	0920		Fuel char transfer lost.
"	1010		Boot and side flows reduced.
"	1025		Lignite feed shutoff.
"	1045		Char feed to the gasifier started. Fuel char transfer regained.
"	1330		Resumed lignite feed to the system.
"	1545		Quench system back to normal operation.
"	1930		Air removed from the gasifier side. Fuel char transfer shook up when switching the char removal lockhoppers.
"	2000		Seal on fuel char flow control valve, LCV-2002 lost. Recovered right away.
"	2120		Char transfer lost while rodding S-13, regained transfer by stroking flow control valve.
1/22	0030		Boot level shaky. NOTE: Raised the boot flow slightly for 15 minutes and then returned it to original flow.
"	0112		Switched from J-201B to J-201A compressor.
"	0130		Raised boot flow slightly.
"	0300		Pin sheared on the Redler conveyor, lignite feed conveyor, in the 100 area. Grinding shut down.
"	0330	120	Started replacing boot recycle with steam.
"	0415		Excess flue gas going to the preheater.
"	0700		Continued adjusting the gasifier flows.
"	2110		Reduced the discharge pressure on J-202, main air compressor, due to a third stage packing leak.
1/23	0900	149.5	Adjusted the gasifier TE's insertion and received a better temperature reading from the bed.
"	0910		J-207A, devolatilizer recycle compressor, started.
"	0915		J-201A, gasifier recycle compressor, shut down for maintenance.
"	1535		Started grinding in the 100 area.
"	1600		Dolomite circulation slowed down due to high gasifier bed density.
"	1730		Introduced air into the side of the gasifier.
"	1855		Started increasing 6 X 9 dolomite makeup and cut the dolomite circulation.

Date	Time	Hours Counting	Description
1/24	0030-0520		Increased withdrawal rates to the char removal hoppers and to the purged dolomite lockhoppers. The bed density continued to rise.
"	0600	170.5	Dolomite transfer through LCV-2003 lost. Upset caused by drift in gasifier boot gas flow control. Steam withdrawn from the gasifier boot and replaced with recycle gas. Lignite feed shut off. Recycle gas added to the regenerator side flow.
"	0610		Flue gas removed from the preheater.
"	0640		Started char feed to the gasifier.
"	0915		Plug in CD-204 line broken up by blowing into S-10 sample point.
"	0940		Dolomite circulation good.
"	1250		Raised steam to the gasifier boot. NOTE: Pulling out excess fines by dumping into the char removal system.
"	0835		100 area grinding mill jammed.
"	1900		Grinding mill shut down for maintenance.
"	1945		Increased steam and air to the gasifier side.
"	2400		Gasifier quench tower plugged.
1/25	0025		Quench system back to normal.
"	0325		Lignite feed started to the gasifier.
"	0720		J-201A, gasifier recycle compressor, shut down.
"	0800		Fuel char transfer lost momentarily. Regained transfer right away.
"	1055		J-207 A and B compressors started. NOTE: System on hold due to a broken mill bottom casting in the 100 area roller mill.
"	1825		Fuel char transfer lost.
"	1900		Fuel char transfer regained.
"	2050		Fresh dolomite makeup shut off.
"	2050		Lignite feed to the gasifier shut off. Char transfer shut off. Reducing gasifier boot heater temperatures. Backing the air out of the regenerator and increasing the recycle. Dolomite transfer through TCV-2030 poor.
"	2230		Steam removed from the gasifier boot.
"	2310		All air out of the gasifier.
1/26	0100		Started adding dead-burned dolomite to the system.
"	0615		Still having trouble transferring through TCV-2030.
1/27	0230		Lowered the gasifier boot flow in order to shower acceptor better.

Date	Time	Hours Counting	Description
1/27	0520		Raised gasifier flows back to normal flow.
"	1000		Lowering gasifier temperatures in order to dump contents.
"	1020		TCV-2030 closed.
"	1045		ZnO towers taken off line.
"	1100		Removed steam from the gasifier side flow and replaced it with recycle gas.
"	1300		Began emptying gasifier contents to F-213.
"	1540		Transferred acceptor through TCV-2030.
1/28	0115		F-206, dolomite feed lockhopper, empty. NOTE: For the last 12 hours, conditioned dolomite was fed to the regenerator. The regenerator contents were transferred to the gasifier and then to F-213.
"	0137		Started raising the temperatures on the gasifier heaters.
"	0540		Transferred a batch of acceptor through LCV-2003. OK.
"	0910		Introduced air into the regenerator ring.
"	1020		Started solids circulation.
"	1330		Stopped solids circulation in order to run gas and solids circulation tests.
"	1635		Circulation tests finished. Continued with circulating solids.
1/29	0612		Dumped a batch of stone to F-213 to check system.
"	0845		TCV-2030 will not stroke. NOTE: Worked on valve. Replaced a shaft key and some packing.
"	1400		TCV-2030 action better and improving.
"	2400		NOTE: Continued circulating solids and withdrawing to F-213.
1/30	0540		Transfer through TCV-2030 lost.
"	0605		Transfer regained.
"	0904		Transfer lost through TCV-2030.
"	0910		Transfer regained.
"	1600		"B" zinc oxide tower placed on line.
1/31	1450		"A" zinc oxide tower placed on line.
"	1600		Started heating up the preheater.
"	2130		Started heating up the 100 area grinding equipment.
"	2215		Stopped solids circulation.
2/1	0110		All air removed from the system.
"	0200		Started grinding char.
"	0300		Shut down grinding.
"	0430		Started grinding again.

Date	Time	Hours Counting	Description
2/1	0445		Introduced steam into the gasifier side flow.
"	0515		Started char addition to the gasifier.
"	0625		Started circulating acceptor.
"	0900		Lost the dryer furnace in the 100 area. Grinding shut down.
"	1000		Introduced air into the gasifier side flow.
"	1015		Dryer furnace fixed and heating up the 100 area.
"	1045		Started grinding char again.
"	1310		Shut down grinding due to plugged fines line.
"	1400		Started grinding again.
"	1420		Finished grinding char and now grinding lignite.
"	1500		Started fuel char transfer to the regenerator. NOTE: Experienced trouble starting char transfer.
"	1630		Raised reactor differential to 8 PSI and gained good char transfer.
"	1830		Added steam to the gasifier boot flow.
"	1945		J-201A taken off line and placed on standby.
"	2030		Fines line on scalping screen plugged, stopped grinding in 100 area.
"	2200		Resumed grinding.
"	2300		Finished lignite grinding and going to char grinding.
2/2	0045	0	Regenerator at 1800^{o}F. All recycle gas removed from the regenerator ring flow.
"	0100		J-207A and B compressors on standby.
"	0215		Resumed lignite grinding.
"	0345		Started feeding lignite to the gasifier.
"	0800		Switched char removal hoppers and upset char transfer momentarily.
"	1200		CO_2 added to the gasifier boot flow.
"	1410		Pin sheared on L-204, fresh dolomite feeder.
"	1600		Replaced pin and sheared it again.
"	1830		Sheared pin replaced.
"	2218		Started feeding 6 X 9 dolomite to the system.
"	2300		Upset in the gasifier boot. Reduced solids circulation, fresh dolomite makeup, and steam to the boot. Recycle gas was increased in the gasifier boot flow.
"	2300		NOTE: Gasifier boot returned to normal after increasing boot flow and then coming back to normal flows.
"	2400		Gasifier boot upset again. NOTE: Increased boot steam flow and the boot stabilized.

Date	Time	Hours Counting	Description
2/3	0250	26	Resumed 6 X 9 dolomite makeup. Switched char removal hoppers and had a small upset with the char transfer.
"	0835		Decreased air to the gasifier side.
"	0915		100 area baghouse has a sheared pin on the carriage chain and a broken gear on the carriage drive.
"	0930		Increased steam to the boot and cut recycle gas.
"	1500		Initiated conservation measures in order to save lignite.
"	2200		J-201A placed on line. J-201B not functioning properly.
"	2250		Feeding char to the gasifier.
"	2340		100 area baghouse repaired.
"	2355		Heating up the 100 area.
1/4	0110		Started grinding lignite again.
"	0240		J-201B compressor shut down.
"	0315	46.5	Started feeding lignite to the gasifier.
"	0732		Reduced air to the gasifier.
"	1000	53.25	Located a hot spot on acceptor lift line, CD-208. Initiated shutdown procedures. Started shutting down the 100 area.
"	1150		Zinc oxide towers taken off line.
2/5	0610		System depressured.

4 RESULTS AND DISCUSSION

4.1 BACKGROUND

Run 22A was conducted with the limited objective of demonstrating plant operation using only steam for the gasifier boot flow. In all previous runs, recycle gas or a combination of recycle gas and steam had been used. Run 22A ended as a result of the step-change approach attempted for removing recycle gas from the boot flow. The rapid adjustment of the boot flow from 50 percent steam to 100 percent steam resulted in unstable boot fluidization due to inadequate steam flow. Approximately 45 minutes after the changeover to 100 percent steam had been made, the boot acceptor bridged causing the recarbonated acceptor standleg, CD-204, to empty. The char bed then defluidized due to the disgorging of acceptor. The gasifier was drained, but acceptor circulation could not be regained through CD-204. Significantly, however, there was no evidence that the use of pure steam per se was in any way detrimental to the process operation.

Between Runs 22A and 22B a major plant turnaround was scheduled in which the following changes were made:

(1) Replacement of the regenerator refractory.

(2) Enlargement of the calcined acceptor standleg, CD-206, from a 4-inch to a 6-inch diameter line.

(3) Modification of the gasifier quench system.

(4) Installation of a second regenerator flue gas cyclone.

(5) Installation of a new gasifier boot gas distributor.

(6) Installation of a gasifier char removal system.

Following the completion of the above items, Run 22B was initiated. The prime objective for this run and Runs 22C and 23 was to achieve longterm, integrated plant operation, preferably for a period of thirty days. Operation of the new char removal system and the modified gasifier quench system was demonstrated during Run 22B. However, prior to the establishment of fresh acceptor makeup, the plant was shut down due to the freezing of the gasifier quench tower level control. The quench tower filled with water and water carried into the flare header and was pumped through the gasifier recycle gas compressors. Following the resulting system overpressurization, the external expansion joint, EJ-4, on the gasifier side flow line was found to be leaking. The plant was then shut down.

In Run 22C the startup proceeded through the stage in which raw lignite was fed to the system and for an eight hour period air was removed as a source of gasifier heat. As in Run 22A, low gas flow to the gasifier boot caused the termination of the run. The boot acceptor bridged causing the recarbonated acceptor standleg to drain. Acceptor lift gas then blew into the gasifier through the empty standleg allowing the acceptor lift line, CD-208 to fill the solids and plug. Since the lift line could not be cleared, the plant was shut down.

Run 23 was the most successful of the four runs. The run featured totals of 218 hours with lignite feed to the system, 199 hours of fresh acceptor makeup, and 53 hours operation without the need for gasifier air addition. Considerably longer periods would have been achieved had not a casting in the lignite roller mill broken. The broken casting forced shutdown of the 100 area grinding system. During the following six days which were required to procure and install a new part, no lignite feed was available to the system. The gasifier was drained and operated in a hold condition. In the hold condition, acceptor was continuously circulated between the regenerator and the gasifier, and the reactors were allowed to cool to a temperature which could be maintained by the recycle gas heaters. Two days after the lignite mill was repaired, a sheared pin and a worn-out gear in the lignite baghouse blower carriage drive forced a downgrading of plant operations to conserve lignite feed for a 15 hour period. Shortly after reliable lignite feed to the system was established, a hot spot developed on the acceptor lift line. A decision was then made to shut down the plant.

Although the lignite grinding system mechanical problems plagued operations throughout the run, Run 23 provided a wealth of information. The sources of the intermediate fines were investigated, the accumulation of this "junk" material was monitored during the run, and most significantly, the run demonstrated that stable boot operation could be achieved by maintaining relatively high fluidizing gas velocities.

4.2 ACCOMPLISHMENTS

4.2.1 Major Operational Achievements

The progress of plant operations for Runs 22 and 23 are summarized below:

SUMMARY OF PLANT OPERATIONS

Run	At Process Conditions	Hours With Lignite Feed	Continuous Acceptor Circulation	With Fresh Acceptor Makeup	Without Gasifier Air
22A	20	19	36	0	0
22B	20	12	82	0	0
22C	64	55	96	27	8
23 (1st period)	170	168	364	167	53
23 (2nd period)	53	50		32	0

The summary shows that the plant was operated at process conditions for significant periods during all runs. Runs 22C and 23 were the most successful featuring 8 and 53 hour periods respectively in which the plant was operated in an integrated manner without the use of air to supply any of the gasifier heating requirements.

4.2.2 Plant Data

Table 22-6 through 22-32 summarize the plant data for each of the four runs. Process operating conditions are shown in Tables 22-6 through 22-13. Analyses of typical feedstocks are presented in Tables 22-14 through 22-17, while analyses of effluent, purged, and circulated materials are presented in Tables 22-18 through 22-32.

Since the Run 22 series did not achieve any extended periods of steady-state operation, some plant data were never obtained. In particular, samples of circulated acceptor were never analyzed for Run 22A and elemental analyses of circulated acceptor for Runs 22B and 22C and elemental analyses for the organic pond solids for Run 22B were not obtained.

4.2.3 Acceptor Lift Line

Acceptor circulation tests were conducted during each run of the Run 22 and Run 23 series. These tests were performed to gather data from which quick estimates of the acceptor circulation during a run

could be made and to provide additional data for incorporation into an existing general lift line pressure drop correlation[1]. As in all runs since Run 17, the tests consisted of two parts: (1) a gas flow test in which the lift line pressure drop was measured for various gas rates without solids circulation; and (2) a solids circulation test in which the lift line pressure drop was measured for various solids circulation rates.

The gas flow tests were conducted to insure system integrity. By measuring the lift line pressure drop due to gas flow only and then comparing the value with the pressure drop predicted by the Fanning equation, shifts in differential pressure instrument range and zeroing errors could be easily detected. The gas flow pressure drop data for the acceptor lift line are presented in Table 22-1 and are plotted in Figure 22-1. To eliminate the need to consider acceleration effects, only data for the upper 34 feet of the lift line are presented. As shown in Figure 22-1, the slope of the predicted versus measured pressure drop is 1.0 for all tests. Therefore, the instrument range remained constant during Runs 22 and 23 time period. The abscissa intercept of 0.8 represents accumulated error for instrument zeroing, gas temperature measurement, and the density effect of the cold purge gas on the measured pressure drop (refer to Run 17 report).

Solids circulation data are presented in Table 22-2. Again, to eliminate the acceleration effects, only the pressure drops over the upper lift line section are considered here. The tests consisted of: (1) establishing continuous steady acceptor circulation between the regenerator and the gasifier reactors in the absence of a gasifier char bed; (2) recording acceptor lift line pressure drop for the steady-state condition; (3) draining the gasifier boot to a low level while maintaining continuous calcined acceptor flow to the gasifier; and (4) recording the time required to fill the gasifier boot after stopping the recarbonated acceptor flow from the gasifier. Differential pressure measurements were used to measure the gasifier boot levels.

The above test procedure has been standard practice since Run 16. However, the procedure was slightly modified during Run 22C to include direct measurement of the lift line pressure drop at constant solids circulation rates for various lift gas flows. These data are presented in Table 22-2 and in Figure 22-2. As shown in the figure for any given set of conditions of lift gas temperature, pressure and solids circulation rate, there exists a lift gas velocity at which the lift line

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[1] Interim Report No. 3, Phase II--Bench-Scale Research on CSG Process, January, 1970. Book 1, Studies on Mechanics of Fluo-Solids Systems, National Technical Information Service PB-184718/AS.

pressure drop will be minimum. Below this velocity the lift line operation is unstable. The line will alternately fill with solids and then empty. This condition could easily lead to plugging of the lift line. For velocities greater than the velocity for minimum pressure drop, the lift line operation is stable. However, increased erosion of the lift line will occur at the higher lift gas rates. The optimum operating condition is for the lift gas velocity to be at or slightly greater than that required for minimum pressure drop. For the conditions of the pilot plant operation the lift gas velocity is maintained between 50 and 60 feet per second.

4.2.4 Control of Intermediate Fines

Following Run 22A, a gasifier char removal system was installed to provide control of the intermediate fines accumulation. The char removal system is shown schematically in Figure 22-3. The system consists of two parallel lockhoppers into which a portion of the regenerator fuel char standleg material is withdrawn. To allow withdrawal of material from the char standleg, CO-202, a 'Y'-shaped spool piece was installed in the standleg at the point at which the 60 degree sloped section joins the vertical line to the char pickup station. To cool the 1400^{o} to 1500^{o}F material, a steam jacket was provided on the line below the 'Y' spool piece.

The idled devolatilizer and gasifier emergency dump hoppers, F-215 and F-216, respectively were modified and used for the char dump hoppers. The vessel modifications included: (1) removal of the 3-inch layer of internal insulation; (2) reducing the length of the inlet pipe neck on the top heads; and (3) the installation of 68 degree cones in the bottom of the vessels. Each vessel provides approximately 20 cubic feet of usable volume for solids removal. Presently, operation is manual. When one hopper is filled, the other hopper is put on stream by opening the ball valve in the line to the empty hopper. The full hopper is depressured and then emptied into a tote bin. The dumped hopper is then repressured and held in a standby condition until the hopper is filled. The flow rate of material to the dump hoppers is controlled by a Posi-Seal butterfly valve in the line below the steam jacket. Level within the hoppers is detected using thermocouples and a vibrating reed device.

Experience gained with the char removal system during Runs 22B and 22C lead to several minor instrumentation changes which improved the reliability of the operation. During Run 23 the char removal system was operated in a manner which effectively controlled the buildup of the intermediate fines material. Figure 22-4 shows a plot of smoothed data for the intermediate fines inventory during the first stage of the run prior to putting the system in a hold condition due to the discovery of a broken casting in the lignite grinding mill. The rate of total solids

removal through the char removal system averaged about 80 LBS/HR prior to the purposeful "dejunking" period which was initiated at 1410 hours on January 24. During the "dejunking" period, the solids removal rate varied between 156 LBS/HR to 217 LBS/HR. As shown in the figure, the high withdrawal rate significantly decreased the total intermediate fines ("junk") within the system.

The regenerator intermediate fines inventory was determined by multiplying the total fluidized bed inventory by the fraction intermediate fines in the calcined acceptor sample which is taken from the calcined acceptor standleg, CD-206. All particles less than 20 Tyler mesh in the calcined acceptor sample were considered to be intermediate fines. Within the gasifier the fraction intermediate fines in the char bed was determined by:

$$F = ((100-PC)*PA)/10^4$$

Where: F = Fraction intermediate fines
PA = Weight percent -Tyler mesh particles in the acceptor fraction of the char bed
PC = Weight percent char in the char bed

The percent char was routinely determined for a sample taken from the char bed using an ashing technique developed by the Rapid City laboratory[2]. The total solids inventories in both the regenerator and gasifier reactors were estimated by:

$$W = \frac{g_c}{g} A \Delta P$$

Where: A = Cross sectional area of the fluidized bed
g = Acceleration of gravity
g_c = Newton's law conversion factor
ΔP = Differential pressure drop across fluidized bed
W = Total weight of solids in fluidized bed

Table 22-3 further demonstrates the effectiveness of the char removal system in controlling the intermediate fines. The table represents a material balance around the gasifier during the 30 hour "dejunking" period. As shown the net intermediate fines removed from the system was 1090 pounds.

During Run 23 the source of intermediate fines was also investigated. Optical microscope examination of the intermediate fines and Scanning Electron Microscope studies have revealed that the majority

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[2] Report covering Runs 19, 20, and 21, page 23.

of the fines consists of a center core of α quartz surrounded by agglomerated acceptor and char ash fines. Based upon elemental analysis of the particles, the fines have been determined to be a combination of approximately 15 percent acceptor fines, 68 percent lignite ash, and 17 percent quartz[3].

The raw lignite and char feedstocks are apparently the source of the quartz grains which serve as nucleation sites for the agglomeration of acceptor and char ash fines. Examination of the as-received coal (samples taken from rail cars) and ground coal (lignite lockhopper samples) reveal that the silica constituents (which include the quartz sand) are concentrated in the finer fractions. Table 22-4 shows compositions of three rail car samples which were screened into +1/4-inch and -1/4-inch fractions. The percent silica in SO_3 free ash for the -1/4-inch fraction is between 1.5 and 2.9 times greater than that in the +1/4-inch fraction. Figures 22-5 and 22-6 which are plots of the data shown in Table 22-5 demonstrate that: (a) the percent silica in the ground product coal is directly related to the percent fines (-100 Tyler mesh); and that (b) the percent silica in the ash is directly related to the amount of ash in the coal.

From this information one can conclude that if the amount of fines fed to the system were minimized, the amount of silica fed would also be minimized and hence, the rate of accumulation of intermediate fines would be reduced. This can be easily achieved by (1) more efficient screening of the ground product coal or (2) prescreening the raw coal feedstock.

4.2.5 Calcined Acceptor Flow Control

Prior to Run 22B, difficulty was experienced in maintaining reliable acceptor transfer at high rates (11,000-12,000 LBS/HR) through the 4-inch ID calcined acceptor standleg, CD-206. Differential pressure measurements across the line indicated that the line was emptying faster than it could be filled. This condition became evident as the dense dead-burned dolomite inventory was replaced by the lighter, coarser fresh acceptor. Additionally, calculations based upon the operation of a 60 degree sloped 3-inch ID standleg indicated that the 4-inch line was being operated at capacity. Therefore, to increase the capacity of CD-206, the internal process containing liner of the standleg was increased to 6-inches ID after Run 22A.

The details of the line modifications are shown in Figure 22-7. The line consists of a 6-inch ID 310 SST pipe within a 14-inch carbon steel pressure jacket. The annular space between the two pipes is filled with hand-packed Kaowool insulation. The inner liner of the outlet nozzle on the regenerator to which the standleg attaches was also increased to 6-inch ID.

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[3] M. S. Lancet, "Physical-Chemical Studies of CO_2 Acceptor Process Bed Material," Conoco Coal Development Company Research Memorandum, RM-13848.

The standleg was also shortened to allow the insertion of an 18-inch long refractory lined spool piece between the lower end of the standleg and the solids flow control valve, TCV-2030. The spool piece design eliminated the need for the S-9 solids sample station line to penetrate the metal liner of the standleg. During earlier operations, the weld at the location of the sample station penetration had often torn loose due to thermal expansion of the piping. This frequently resulted in sampling difficulties and was a maintenance problem.

The above modifications greatly improved the operation of the standleg and eliminated the capacity limitation. No difficulties have been experienced in operating the line at transfer rates between 12,000 and 16,000 LBS/HR.

4.3 PROBLEMS

4.3.1 Regenerator Quench System Operation

Since repositioning the regenerator quench tower venturi, L-315, in a vertical position, elimination of the original horizontal solids separator, F-320, below the quench tower, E-302, and the replacement of the bottom dished head on the quench tower with cone, the operation of the regenerator quench system has been relatively trouble-free. Some solids buildup in the horizontal pipe section between the venturi and the quench tower is still experienced. However, this does not represent a significant problem since periodic rodding of the line keeps the pipe clear.

The major operating difficulty occurs when gasifier-regenerator pressure swings cause excessive solids carry-over from the regenerator which overload the upstream ash cyclone, F-202. Coarse solids and fines are then carried into the quench system. This has on occasion caused plugging of the quench tower bottom drain. To further reduce the amount of fines reaching the quench system and the possibility of coarse particle carry-over, a second cyclone, F-202A, was installed in series with the original L-202. Figure 22-8 shows the new installation. The dual cyclone arrangement has worked well in eliminating massive solids carry-over into the quench system and has markedly reduced the amount of buildup in the horizontal pipe section between the venturi and the quench tower.

4.3.2 Gasifier Quench System

The gasifier quench system has been a continual source of system pressure upsets due to plugging of the horizontal solids separator drains, plugging of the drains from the quench water stripper, F-321, and plugging of the line between the quench tower, E-301, and the solids separator due to the accumulation of solids in the bottom dished head of the quench tower.

Following Run 22A the entire quench system was revised to improve operation. The modified system is shown in Figure 22-9. Since oils and tars are not generated in the gasifier, the horizontal oil, water, solids separators below the quench tower and the quench stripper were not needed and so were eliminated. To avoid the buildup of solids on the bottom dished head of the quench tower, a cone bottom was installed. To provide for solids settling within the quench tower, the bottom twelve disk and donut trays were removed. Pump suction for recycle water to the tower sprays was withdrawn above the cone bottom. The concentrated, settled solids were then withdrawn through a drain in the bottom cone to a new flash pot, F-224. The flash pot provided for degassing of the spent quench water before the water and solids were discharged to the organic waste pond.

The equipment modifications greatly improved the operation of the gasifier quench system. However, several quench system process upsets occurred during Runs 22B and 23. The Run 22 upset occurred when the quench tower level controller froze due to cold weather conditions. This resulted in a system overpressure due to the carryover of water into the recycle gas compressors and the venting of water through the gasifier backpressure control valve, PCV-2022, to the flare header. During Run 23 some plugging of the drains from the quench tower and the flash tank was experienced. The plugging apparently resulted from the sloughing of scale from the quench tower walls. Improved gas solids contacting in the tower or the use of a venturi scrubber ahead of the tower might help eliminate the wall scaling problem.

4.3.3 Lift Line Erosion

Erosion of the acceptor and char lift lines, CD-208 and CO-204 respectively was experienced during Runs 22 to 23 series. Following Run 22B, a one-inch diameter hole was discovered in the upper bell-shaped internal slip joint of the fuel char lift line. Since the slip joint had been in service for the past three years without failure, cone-shaped slip joints similar to those used in the acceptor lift line were not considered to be absolutely necessary. Therefore, the two original slip joints were replaced with identical Incoloy 800 units which were weld overlayed with Stellite 12.

The Run 22C shutdown revealed erosive penetration of the inner liner of the slide valve, XCV-2010. The valve is located between the upper end of CD-208 and the bottom nozzle of the regenerator. The internal liner of the regenerator nozzle had also been eroded through. The erosion was apparently due to deflection of the lift gas flow due to either irregularities in the lift line or in the valve or possibly due to slight misalignment of the slip joint below XCV-2010.

The vessel nozzle was repaired by replacing the liner with a new 4-inch ID Incoloy 800 sleeve. Insulation of the sleeve from the outer pressure containing nozzle wall was provided by a second sleeve of Resco AA-22 refractory with Kaowool insulation packed into the annular space between the AA-22 and the pressure containing wall. The slide valve was replaced with an available identical unit.

Run 23 was ended due to the rapid development of a hot spot on the external pressure containing jacket of CD-208. Inspection of the inner process containing liner showed that an 8-inch by 3-inch hole had developed approximately 12 inches above the bottom cone-shaped slip joint. The erosion was apparently caused by misalignment of the slip joint cone. This may have been due to weld stresses which caused off centering of the slip joint when the line was heated to operating temperature.

Erosion of the upper slip joint cone was moderate and uniform except in one small area in which two pin holes had developed. Since Run 21 when both slip joint cones were installed, the cones had seen approximately 630 hours of acceptor circulation. The cones were replaced with new cones which were overlayed with Stellite 12 using longitudinal weld beads instead of circumferential beads.

Alternate lift line designs are now being considered including all refractory or ceramic designs. However, for the immediate future, the present design is considered to be reliable enough to allow for a thirty day run.

4.3.4 Expansion Joint Failures

Run 19 was the first run in which failures of the 304 SST bellows type expansion joints on the double-walled hot lines were experienced. Mechanical failures of bellows units continued to be a problem during Run 22. An early startup attempt for Run 22A ended when a leak was discovered in the lower bellows unit, EJ-15, on the acceptor lift line, CD-208. Run 22A was terminated when a leak developed in the expansion bellows, EJ-4, which is on the gasifier side flow line, CO-203.

The EJ-4 bellows which had been replaced after Run 19 with an available 304 SST unit failed after only 31 days of service. This unit which is exposed to air, steam, and recycle gas (CO_2, N_2) at 200° to 300°F and 150 PSIG on the inside and to ambient conditions on the outside was sent to Continental Oil Company's Maintenance Engineering Department in Ponca City, Oklahoma, for analysis. Trans-granular cracking of the metal typical of chloride stress corrosion cracking was determined to be the cause of the bellows failures. Most of the cracking occurred on the inside of the bellows.

To avoid future failures, the bellows units were replaced with new units made of solution annealed Incoloy 825, an alloy which is resistant to chloride attack. The EJ-15 bellows was replaced during Run 22A, and EJ-4 was replaced after Run 22B. Although EJ-16, the upper expansion joint on CD-208, did not fail, the bellows were replaced after Run 22A with an Incoloy 825 unit.

4.3.5 Deposits

Since the advent of the use of dead-burned dolomite as plant startup material, deposits have formed in the gasifier boot and in the cone section of the regenerator bottom head. The location and shape of the deposits, which have been principally agglomerated dead-burned dolomite, indicates that the deposits form in areas in which the acceptor is allowed to defluidize. Scanning Electron Microscope and X-ray diffraction studies also suggest that the agglomerates are formed when the acceptor is not fluidized[4]. The studies which were conducted by Conoco Coal Company's Research Department showed that the bridges or linkages between particles were enriched in calcium, a condition which would be favorable if the contacting particles were immobile.

To prevent particle agglomeration, efforts were made to improve the gas distribution in the gasifier boot. Before Run 21 a ball and metal grate type gas distributor was installed in the gasifier bottom head as shown in Figure 22-10. The two-inch diameter balls were made from Resco AA-22 refractory and were installed below the metal grate. Based upon differential pressure measurements across the boot during the run the new distributor appeared to have improved the boot fluidization. However, after the run a large deposit was found on and above the distributor grate. Following Run 22A the grate was found to be plugged with only the center-most holes open. The refractory balls were also found to have been cemented together by deposit. Since the ball type gas distributor did not work well, tests were conducted in a 12-inch diameter glass model to determine the best possible design. Six different designs were studied. Figure 22-11 shows the best distributor of those tested. The unit consists of a plenum chamber on which bubble cap type gas distributors are located. The design distributes the gas flow evenly and prevents solids from plugging the gas distributor in the event of fluidizing gas loss. Dead areas behind the solids withdrawal lines, CD-204 and UAD-206, were eliminated by cutting the lines off at the walls.

The new distributor worked well during the following runs. After Run 22B, only 5 to 10 pounds of deposit were found, most of which was wet, crumbly material between the gas distributors. A small amount of loose, soft material around the caps was also found after Run 22C.

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[4] Ibid.

The Run 23 inspection revealed that two small cone-shaped deposits had formed which covered approximately one-third of the distributor caps. The new distributor apparently has significantly improved the boot fluidization. The deposits which formed apparently had no effect on the boot operation and were always smaller than those discovered after earlier runs before the installation of the new distributor. If all nonfluidized areas were eliminated, the deposits would probably not form.

5 FUTURE PLANS

The objectives for Run 24 are the same as those for Runs 22 and 23, namely, (1) to obtain a run of long duration to demonstrate process and reliability and (2) to use only steam for boot fluidization. Run 24 will be attempted as soon as repairs to the plant are completed.

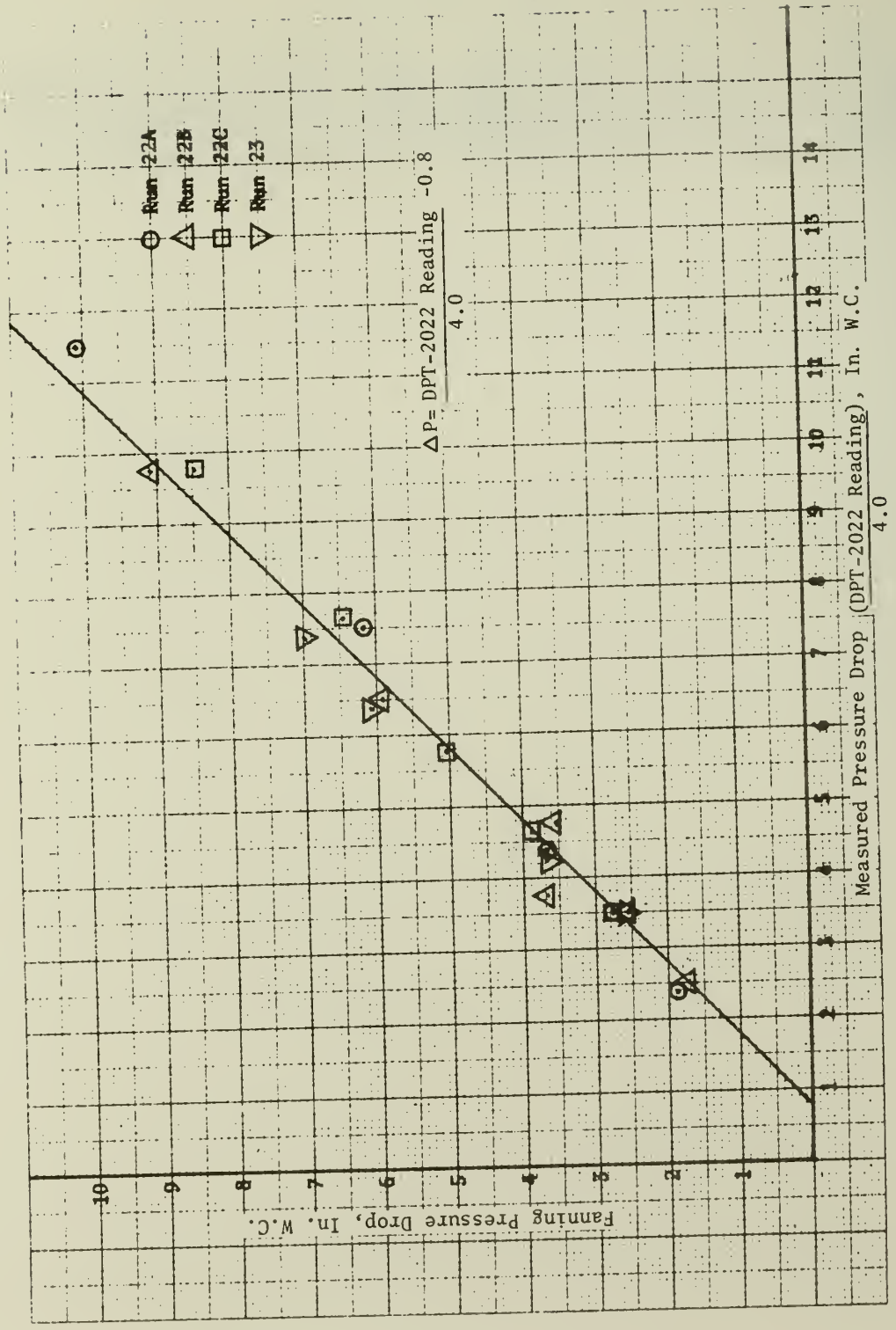
Run 22A
Run 22B
Run 22C
Run 23
ΔP= DPT-2022 Reading -0.8 / 4.0
Fanning Pressure Drop, In. W.C.
Measured Pressure Drop (DPT-2022 Reading), In. W.C. / 4.0

Figure 22-1. UPPER LIFT LINE PRESSURE DROP, THEORETICAL VERSUS MEASURED

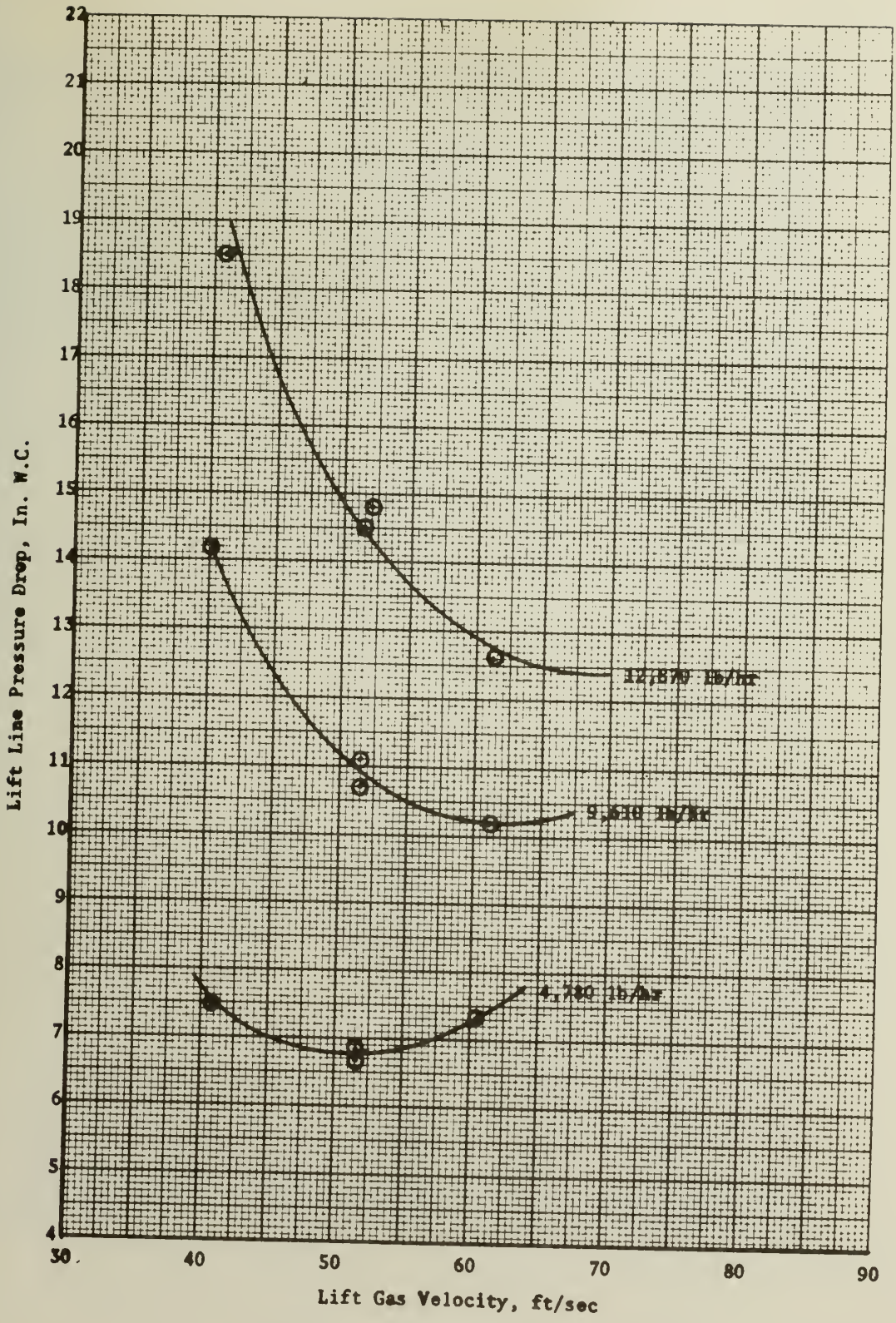

Figure 22-2. LIFT LINE PRESSURE DROP AS A FUNCTION OF LIFT GAS RATE AND SOLIDS CIRCULATION, RUN 22C

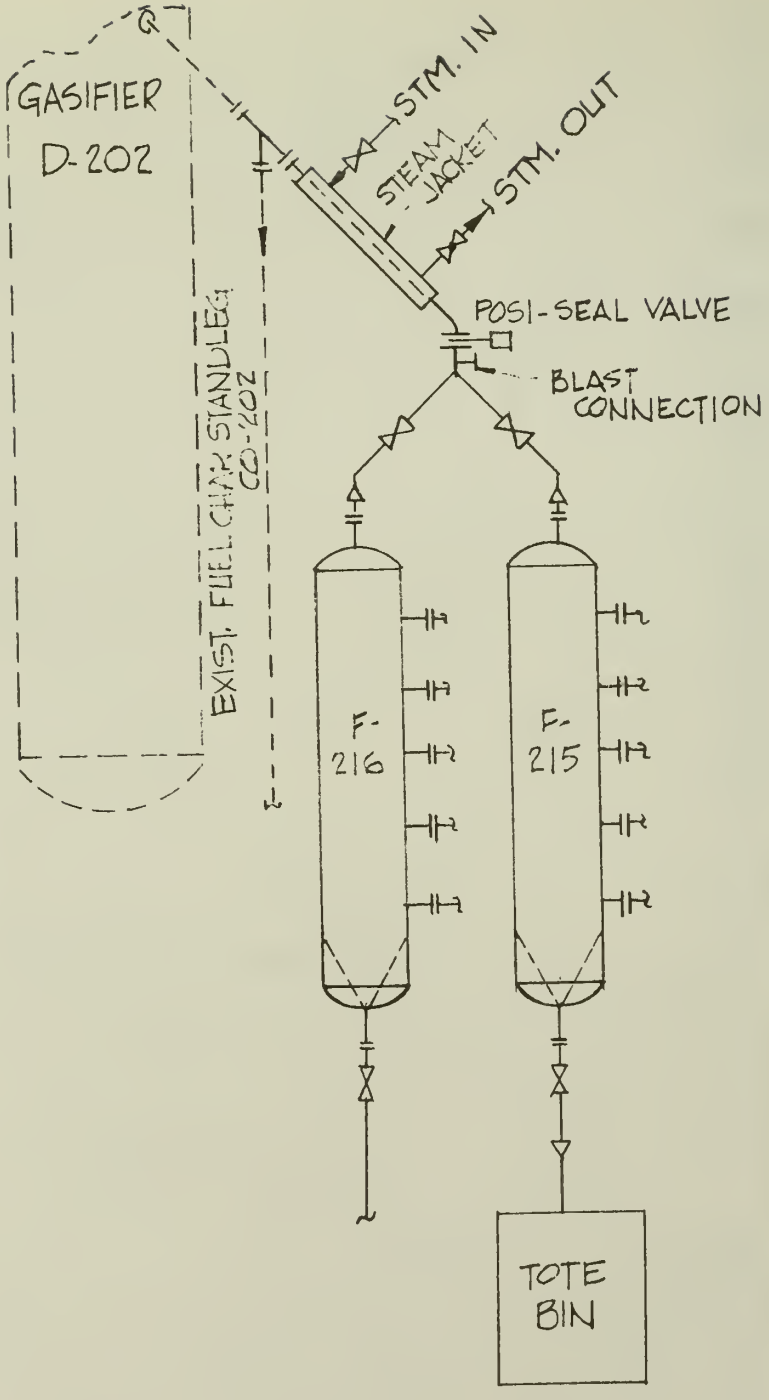

Figure 22-3. CHAR REMOVAL SYSTEM

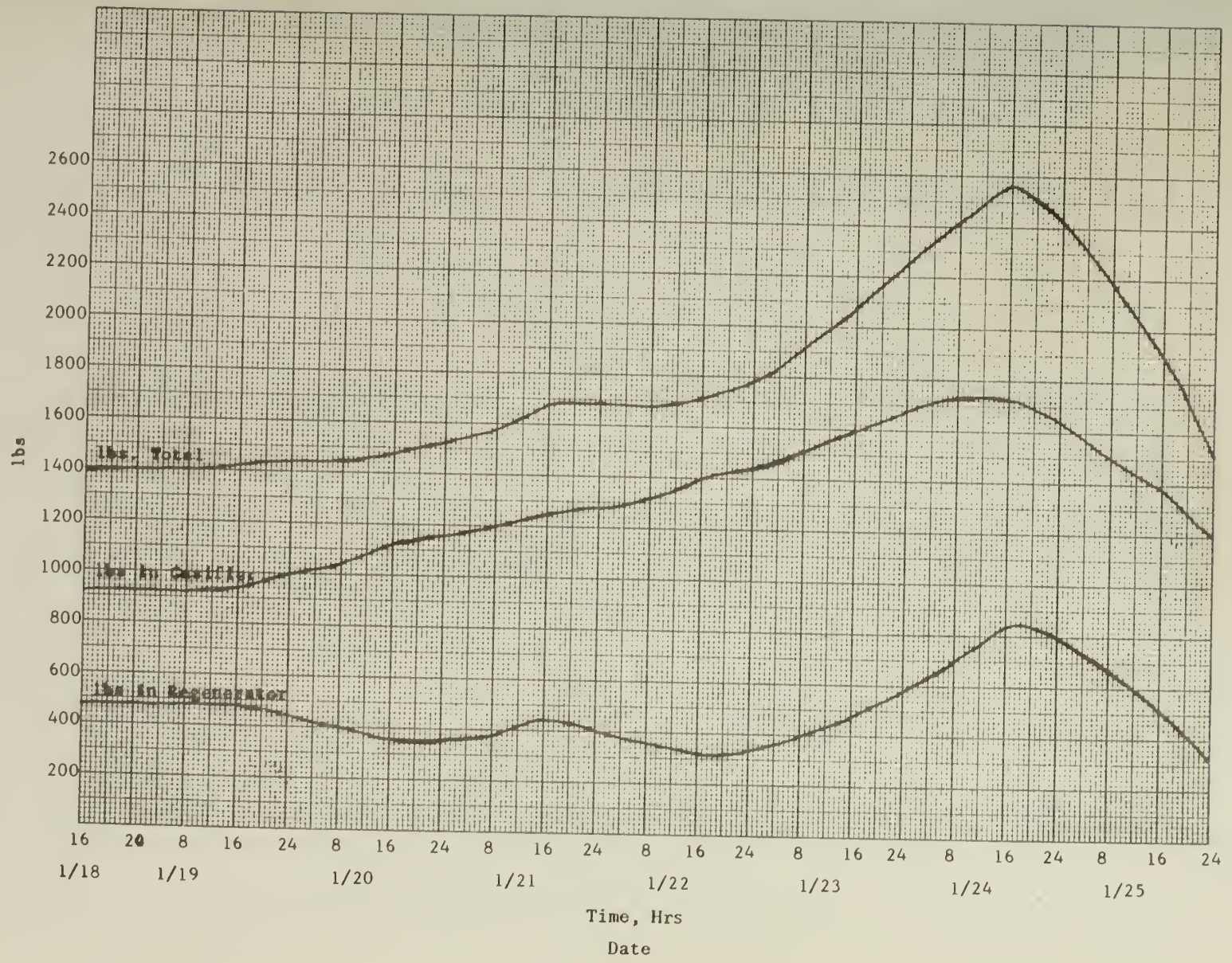

Figure 22-4. INTERMEDIATE FINES INVENTORY, RUN 23

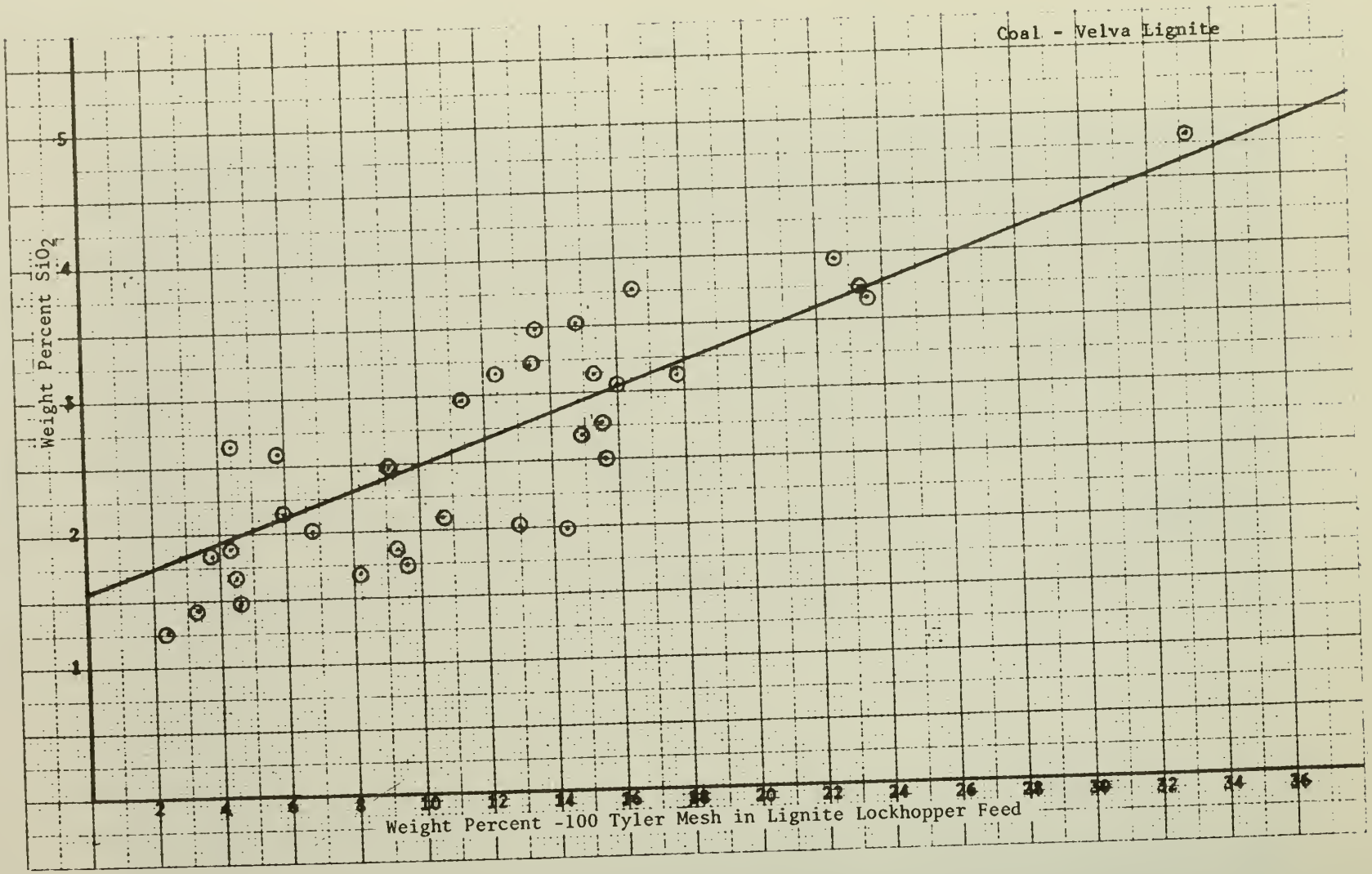

Figure 22-5. WEIGHT PERCENT SiO_2 IN COAL VERSUS WEIGHT PERCENT FINES

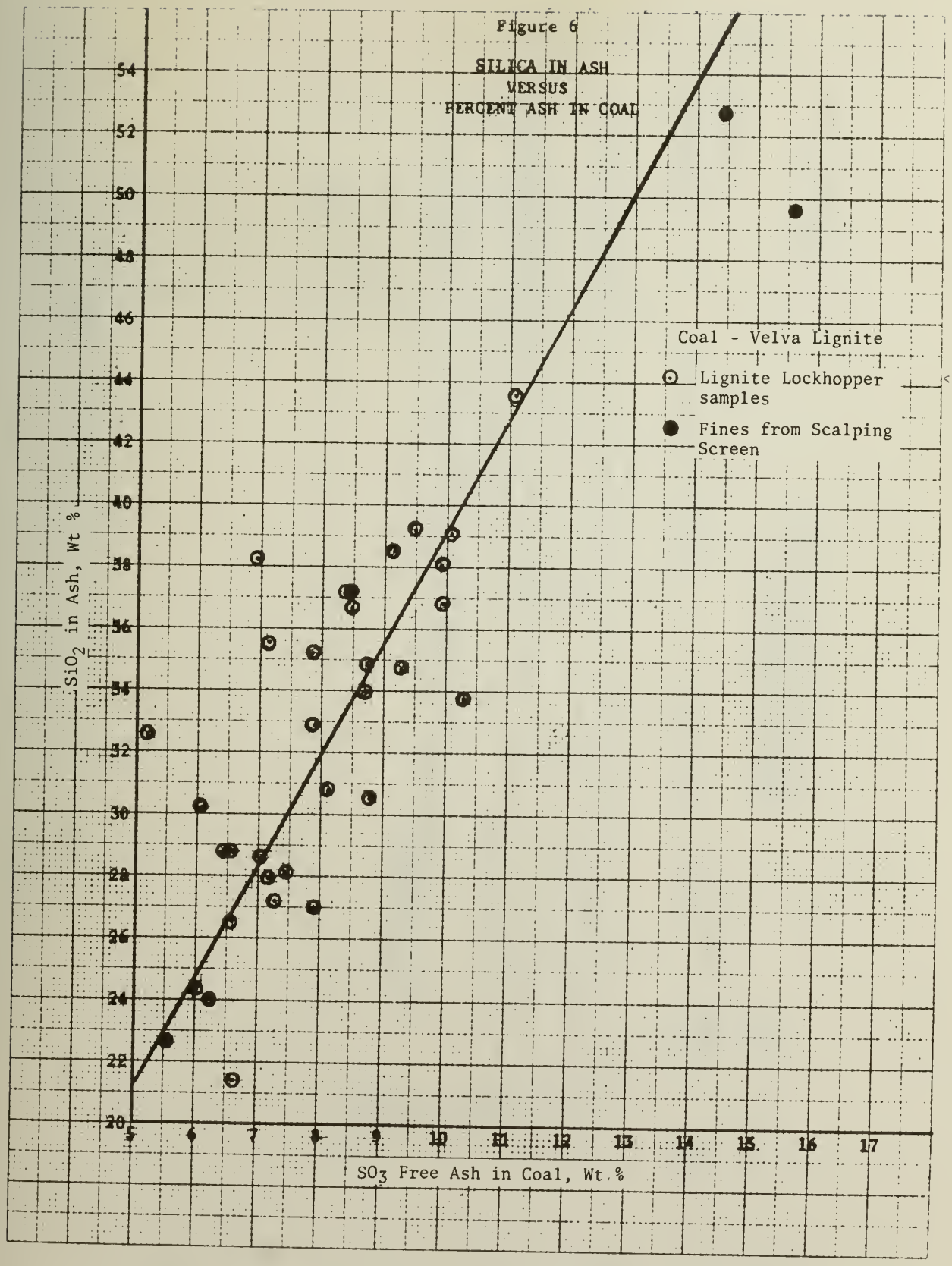

Figure 22-6. SILICA IN ASH VERSUS PERCENT ASH IN COAL

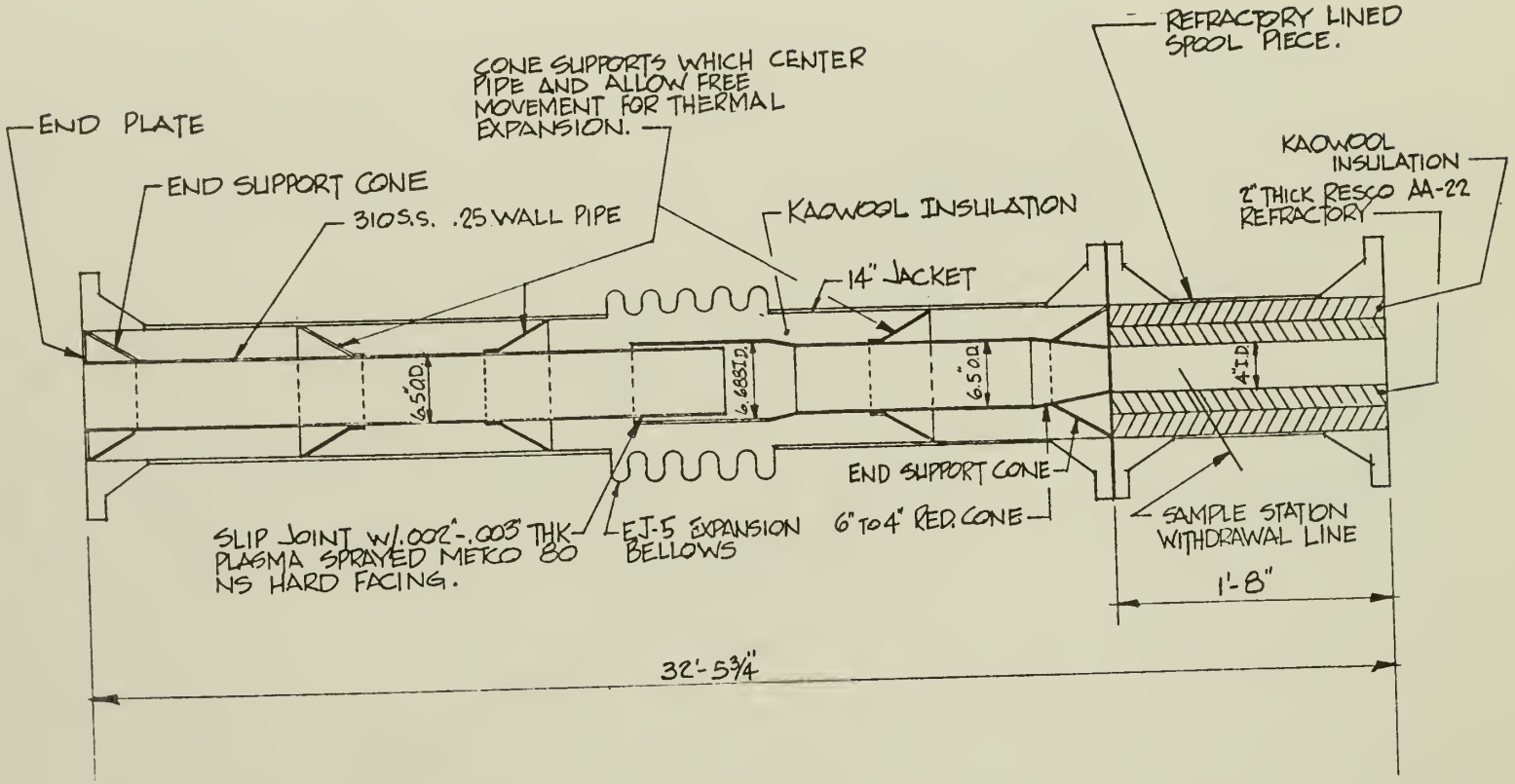

Figure 22-7. CALCINED ACCEPTOR STANDLEG DESIGN

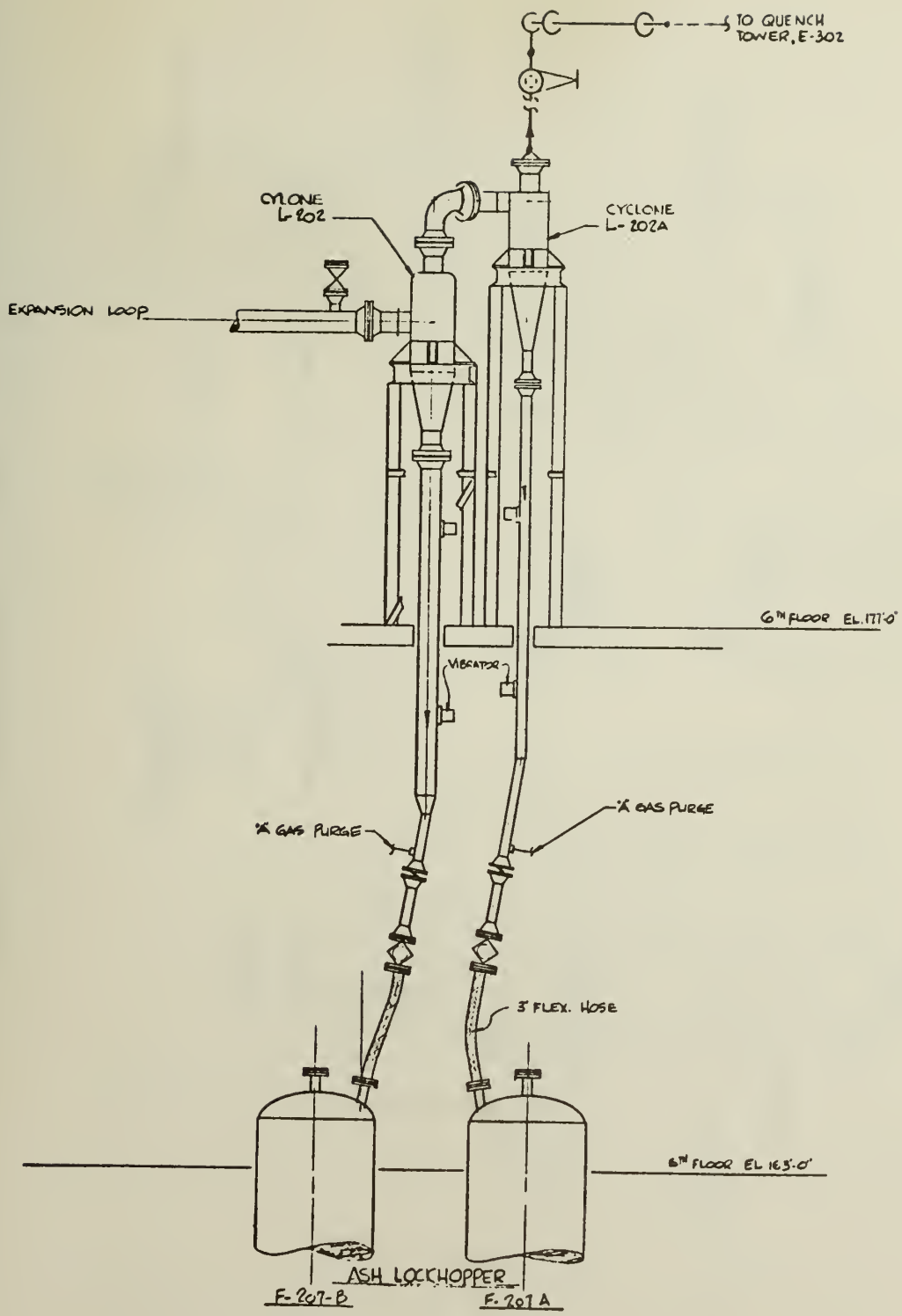

Figure 22-8. MODIFIED REGENERATOR CYCLONE INSTALLATION

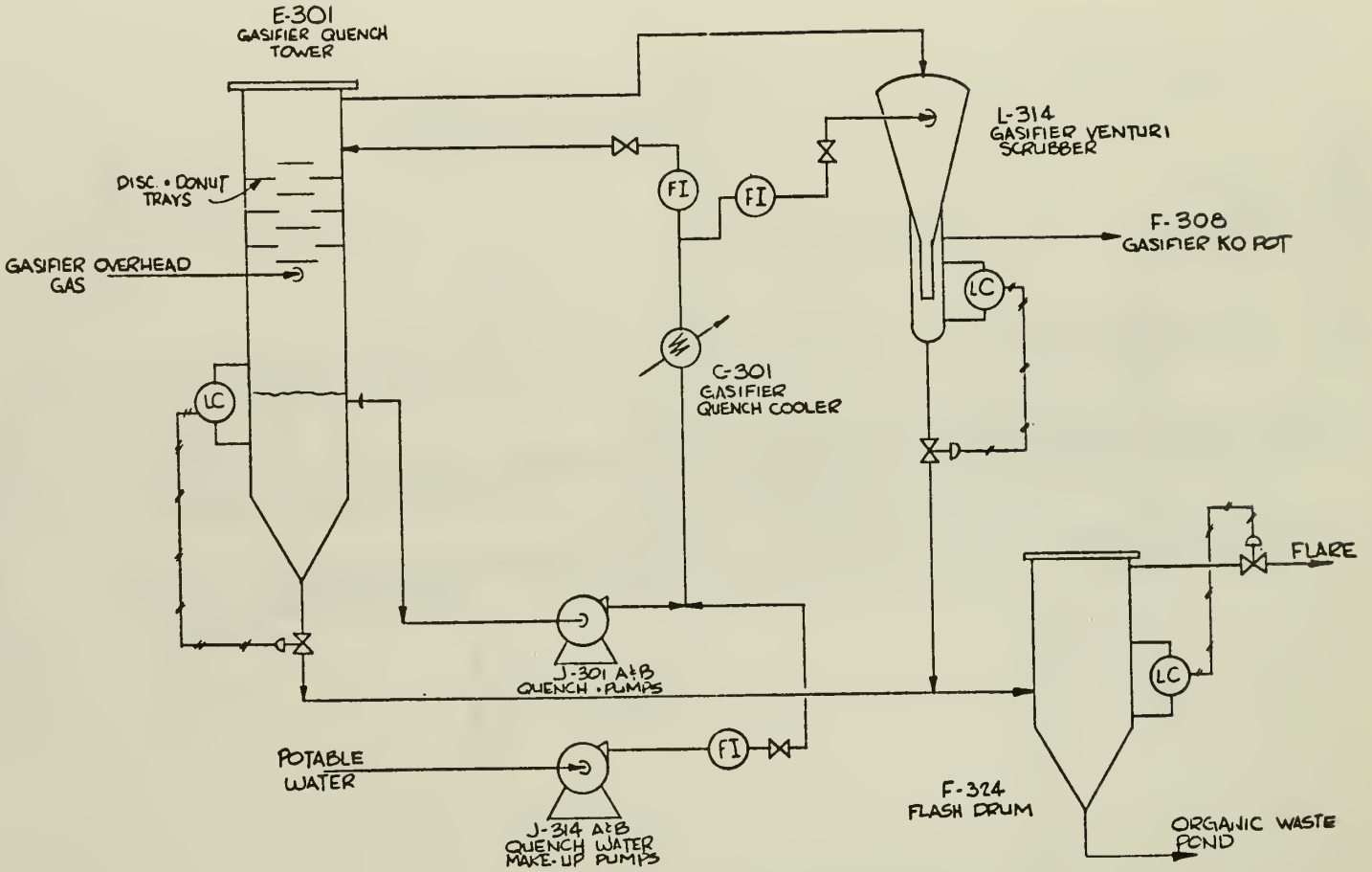

Figure 22-9. REVISED GASIFIER QUENCH SYSTEM

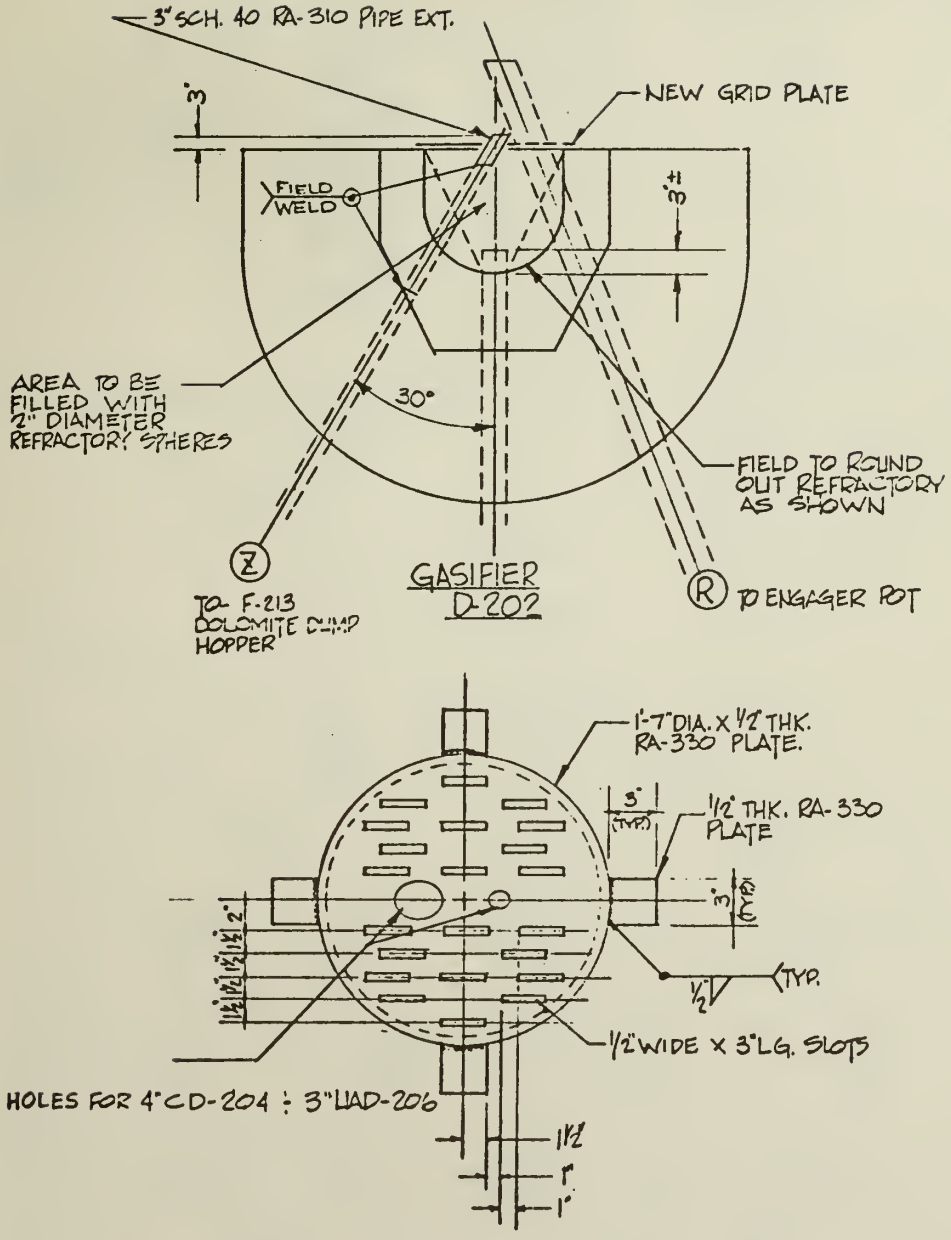
3" SCH. 40 RA-310 PIPE EXT.
NEW GRID PLATE
FIELD WELD
AREA TO BE FILLED WITH 2" DIAMETER REFRACTORY SPHERES
30°
FIELD TO ROUND OUT REFRACTORY AS SHOWN
GASIFIER D-202
TO F-213 DOLOMITE DUMP HOPPER
TO ENGAGER POT
1'-7" DIA. X 1/2" THK. RA-330 PLATE.
1/2" THK. RA-330 PLATE
TYP.
1/2" WIDE X 3" LG. SLOTS
HOLES FOR 4" CD-204 & 3" LIAD-206

Figure 22-10. GRID PLATE GAS DISTRIBUTOR

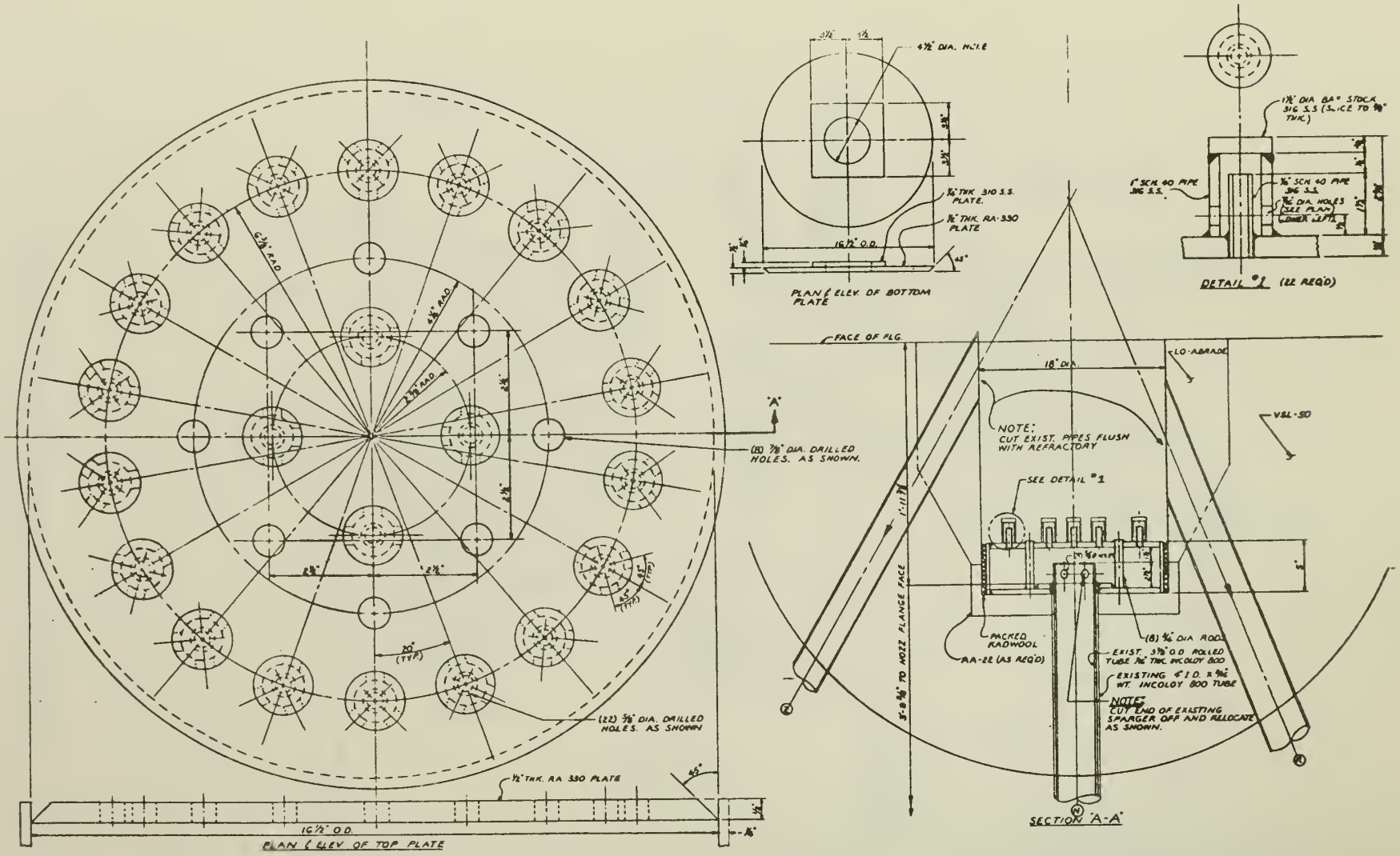
4½" DIA. HOLE
¼" THK 310 S.S. PLATE.
¼" THK. RA-330 PLATE
16½" O.D.
PLAN & ELEV. OF BOTTOM PLATE
1⅞" DIA BAR STOCK 316 S.S (SLICE TO ⅜" THK.)
1" SCH 40 PIPE 316 S.S.
½" SCH 40 PIPE 316 S.S.
DETAIL "1" (22 REQ'D)
FACE OF FLG.
18" DIA
LO-ABRADE
VEL-80
NOTE: CUT EXIST. PIPES FLUSH WITH REFRACTORY
SEE DETAIL "1"
PACKED RADWOOL
AA-22 (AS REQ'D)
(8) ⅝" DIA ROD
EXIST. 3⅞" O.D ROLLED TUBE ⅜" THK. INCOLOY 800
EXISTING 4" I.D. x ⅜" WT. INCOLOY 800 TUBE
NOTE: CUT END OF EXISTING SPARGER OFF AND RELOCATE AS SHOWN.
3'-0⅜" TO NOZZ FLANGE FACE
SECTION "A-A"
(80) ⅞" DIA. DRILLED HOLES. AS SHOWN.
(22) ⅞" DIA. DRILLED HOLES. AS SHOWN
½" THK. AA 330 PLATE
16½" O.D.
PLAN & ELEV OF TOP PLATE

Figure 22-11. GASIFIER BOOT GAS DISTRIBUTOR

Run	Lift Gas Flow, SCFH	Lift Gas Temperature, °F	Lift Gas Pressure, PSIA	Upper Lift Line Pressure Drop, In. W.C. Measured	Fanning
22A	40,000	1250	173	2.38	1.89
	49,690	1250	173	3.50	2.78
	58,180	1250	173	4.38	3.68
	77,570	1250	173	7.50	6.17
	101,810	1250	173	11.5	10.1
22B	39,040	1170	173	2.50	1.71
	48,800	1170	173	3.50	2.55
	58,560	1170	173	4.75	3.53
	78,080	1170	173	6.50	5.91
	98,820	1170	173	9.75	9.04
22C	50,760	1150	168	3.50	2.77
	61,160	1150	168	4.63	3.87
	70,840	1150	168	5.75	5.04
	81,210	1150	168	7.63	6.45
	94,430	1150	168	9.75	8.46
23	48,640	1170	171	3.50	2.56
	59,580	1170	171	4.25	3.68
	78,800	1170	171	6.38	6.08
	85,120	1170	171	7.38	6.99

Table 22-1. ACCEPTOR LIFT LINE GAS, FLOW TEST DATA, RUN 22 AND 23

Solids Circulation Rate, lb/hr	Lift Gas Velocity, ft/sec	Lift Gas Temperature, °F	Lift Gas Pressure, PSIA	Upper Lift Line Pressure Drop, In. W.C. Measured	Corrected	Fanning
Run 22A						
Date - 9/24/74						
Lift Gas - Air						
6,340	55.5	1150	173	9.25	8.45	4.34
17,030	56.0	1150	173	20.0	19.20	4.42
Run 22B						
Date - 11/26/74						
Lift Gas - Air						
2,690	45.5	1180	173	5.0	4.20	3.00
7,060	45.5	1180	173	10.0	9.20	3.00
15,620	44.9	1180	173	20.8	20.00	2.94
Run 22C						
Date - 12/16/74						
Lift Gas - Air						
4,780	51.5	1150	171	7.50	6.70	3.76
4,780	40.8	↓	↓	8.25	7.45	2.48
4,780	60.5			8.13	7.33	5.03
4,780	51.5			7.63	6.83	3.76
9,610	51.5			11.50	10.70	3.76
9,610	40.3			15.00	14.20	2.42
9,610	61.1			11.00	10.20	5.12
9,610	51.5			11.85	11.08	3.76
12,870	51.5			15.25	14.45	3.76
12,870	40.8			19.25	18.45	2.48
12,870	61.2			13.38	12.58	5.12
12,870	52.0			15.63	14.83	3.83
Run 23						
Date - 1/16/75						
Lift Gas - Air						
4,740	50.7	1170	171	7.25	6.45	3.64
10,370	50.7	1170	171	12.75	11.95	3.64
12,310	50.7	1170	171	16.25	15.45	3.64
5,390	51.2	1150	168	7.5	6.70	3.68
8,040	51.2	1150	168	10.5	9.70	3.68
11,180	51.2	1150	168	13.75	12.95	3.68

Table 22-2. DEAD-BURNED DOLOMITE CIRCULATION DATA, RUNS 22 AND 23

Input

Intermediate Fines in Feedstocks

Husky Char, 20,100 lbs (1.65% Junk), lbs	332
Velva Lignite, 30,700 lbs (1.05% Junk), lbs	322
Total New Junk Material	654

Output

Char Removal Hoppers

← Time →			Solids Removed →						
			Total	← Weight, % →			← Lbs →		
On	Off	Hrs.	Lbs	Char	Acceptor	Junk	Char	Acceptor	Junk
1410	1935	5.42	1,175	30.6	46.8	22.6	360	550	266
1935	0145	6.17	1,085	40.0	34.5	19.5	499	374	212
0145	0745	6.00	1,185	37.8	38.9	23.3	448	461	276
0745	1315	5.50	860	48.5	27.7	23.8	417	238	205
1315	1810	4.92	770	47.5	25.6	26.9	366	197	207
1810	(2025)	2.25	265	51.0	19.3	29.7	135	51	79
								Total	1,245

Purged Acceptor Hopper

1410	0130	4240	-	94.0	6.0	-	3,986	254
0130	2025	6630	-	96.3	3.7	-	6,385	245
							Total	499

Net Junk Removal (Output-Input), lbs 1,090 lbs

Table 22-3. INTERMEDIATE FINES REMOVAL DURING "DEJUNKING PERIOD" (1410 HRS 1/24/75 TO 2025 HRS 1/25/75), RUN 23

Date 9/19/74

Rail Car No.	6305		60341		6511	
	+1/4	-14M	+1/4	-14M	+1/4	-14M
Screen Size, Wt %						
Tyler Mesh						
+1/4		80.0		78.9		82.9
-1/4		20.0		21.1		17.1
8		53.8		42.0		33.8
10		12.2		12.9		12.7
14		9.0		10.9		11.2
Pan		24.9		34.2		42.3
Ultimate Analysis, Wt %(1)						
HOH (As Received)	(39.51)	(38.79)	(38.47)	(35.20)	(39.64)	(39.82)
C	65.37	60.18	63.81	61.72	64.79	60.16
H	4.08	3.95	4.78	3.96	4.52	3.93
S	0.45	0.68	0.48	0.72	0.49	0.84
Ash + SO_3	7.43	14.04	7.29	13.00	6.63	13.32
Elemental Analysis, Wt %						
SiO_2	14.39	39.32	24.23	35.40	17.80	38.82
SiO_2(2)	15.38	44.31	26.52	40.83	19.22	43.70
SO_3	6.45	11.27	8.63	13.29	7.41	11.17
Na_2O	1.65	0.92	1.46	0.90	1.65	0.91

(1) Dry basis
(2) SO_3 free ash basis

Table 22-4. RAW VELVA LIGNITE SAMPLES (AS RECEIVED FROM MINE)

Date	1/18/75	1/19/74	← 1/20/74 →					
Sample No.	5877	5918	5925	5933	5947	5953	5960	5968
Screen Size, Wt % Tyler Mesh -100	8.2	5.9	4.5	2.4	3.3	14.4	13.0	4.6
Analyses, Wt % Ash (SO_3 Free)	5.17	7.90	6.23	5.55	6.62	7.29	7.02	6.01
SiO_2 in Ash	32.56	27.05	24.02	22.72	21.41	27.21	28.65	24.25
SiO_2 in Sample	1.68	2.14	1.67	1.26	1.42	1.99	2.01	1.46

Date	← 1/21/75 →				← 1/22/75 →				
Sample No.	5979	5985	5992	6003	6009	6017	6023	6046	6054
Screen Size, Wt % Tyler Mesh -100	15.6	6.8	13.4	9.3	33.2	22.6	23.3	11.3	23.5
Analyses, Wt % Ash (SO_3 Free)	8.13	7.16	9.27	6.46	11.08	10.09	9.48	8.71	9.92
SiO_2 in Ash	30.80	27.97	34.68	28.80	43.55	39.10	39.26	33.92	36.85
SiO_2 in Sample	2.50	2.00	3.21	1.86	4.83	3.95	3.72	2.96	3.65

Table 22-5. GROUND VELVA LIGNITE ANALYSES (Sheet 1 of 2)

Date	← 1/23/75 →					1/24/75	1/25/75
Sample No.	6060	6064	6081	6089	6099	6103	6174
Screen Size, Wt % Tyler Mesh -100	16.5	15.3	9.1	13.6	10.7	14.8	12.4
Analyses, Wt %							
Ash (SO_3 Free)	9.90	8.40	7.11	10.30	7.42	9.17	8.49
SiO_2 in Ash	38.02	37.21	35.56	33.77	28.14	38.53	37.20
SiO_2 in Sample	3.76	3.13	2.53	3.48	2.09	3.53	3.16

Date	← 2/2/75 →				2/3/75		← 2/4/75 →		
Sample No.	6353	6354	6384	6385	6419	6444	6468	6477	6486
Screen Size, Wt % Tyler Mesh -100	17.8	16.0	15.5	4.3	14.9	9.6	3.8	4.4	5.8
Analyses, Wt %									
Ash (SO_3 Free)	8.49	8.74	7.87	6.55	8.78	6.56	6.09	6.93	7.87
SiO_2 in Ash	36.73	34.87	35.23	28.86	30.56	26.52	30.22	38.22	32.87
SiO_2 in Sample	3.12	3.05	2.77	1.89	2.68	1.74	1.84	2.65	2.59

Table 22-5. GROUND VELVA LIGNITE ANALYSES (Sheet 2 of 2)

Date	← 9/25/74 →			← 9/26/74 →		
Time	0700	1500	2300	0700	1510	1700
Jacket Steam Make, lb/hr	0	0	0	0	0	0
Solids						
Feedstock	Husky Char		← Velva Lignite →			
Feed Rate, lb/hr[1]	2,420	0	1,660	1,710	2,020	2,770
Dump Acceptor, lb/hr	360	360	← 311 →			
Gas Flows[2]						
Boot (Recycle), SCFH	32 ?00	20,600	13,600	24,700	7,090	0
Boot (Steam), SCFH	0	7,480	16,100	14,700	31,100	41,300
Steam to Side, SCFH	30,900	31,100	19,500	20,700	24,700	24,900
Air to Side, SCFH	14,700	25,600	23,900	24,600	23,500	25,300
Purges						
Recycle, SCFH	4,353	4,049	4,085	4,022	4,183	4,237
Inert, SCFH	387	387	387	387	387	387
Total Flow In, SCFH	83,240	89,216	77,572	89,109	90,960	96,124
Vent Rate, SCFH	23,800	48,300	64,900	59,700	73,400	Off Scale
Bed Conditions						
Boot Velocity, ft/sec	1.40	1.40	1.58	2.07	2.02	2.15
Char Bed Velocity Inlet, ft/sec	0.71	0.87	0.79	0.90	0.93	0.98
Boot Density, lb/ft^3[3]	78	96	93	92	90	87
Char Bed Density, lb/ft^3[3]	44	42	41	42	41	36
Boot Temperature, °F	1120	1390	1505	1493	1497	1470
Char Bed Temperature, °F	1186	1409	1516	1491	1505	1498
Overhead Gas Compositions, Mol %						
CO	3.7	16.3	21.4	18.6	26.5	26.5[5]
CO_2	21.9	23.4	12.4	14.5	17.1	17.1
N_2	57.2	26.7	32.8	35.1	23.2	23.2
H_2	11.0	30.0	29.3	26.4	26.6	26.6
CH_4	6.1	3.6	4.1	5.4	6.6	6.6
H_2O Mol Fraction[4]	24.2	26.8	15.1	17.1	15.0	14.8

(1)
(2) Determined by feeder RPM. PPH = 504*RPM-100
(3) Determined by orifice flow meter measurements
(4) Determined by differential pressure measurements
(5) Calculated by water gas shift equilibrium
Gas analysis for 1510 hrs assumed

Table 22-6. GASIFIER DATA, RUN 22A

Date	9/25/74			9/26/74		
Time	0700	1500	2300	0700	1510	1700
Jacket Steam Make, lb/hr	270	270	270	320	320	340
Solids						
Acceptor Feedstock	Dead-Burned Dolomite					
Acceptor Makeup, lb/hr	327	352	727	533	533	424
Acceptor Circulation, lb/hr(1)	6,120	6,670	11,100	9,450	15,300	14,700
Ash & Attrited Acceptor, lb/hr(2)	55	-	-	16	93	93
Gas Flows(3)						
Acceptor Lift, SCFH	58,200	57,000	56,400	57,200	56,400	56,700
Char Lift, SCFH	7,720	7,790	7,800	6,730	7,440	7,570
Air Line						
Recycle, SCFH	69,900	72,600	23,300	53,200	36,100	29,800
Air, SCFH	0	0	51,500	38,800	59,800	63,600
Purges						
Recycle, SCFH	435	428	424	431	425	427
Inert, SCFH	1,480	1,480	1,480	1,480	1,480	1,480
Nitrogen, SCFH	1,377	1,472	1,472	1,377	1,520	1,520
Total Flow In, SCFH	139,112	140,770	142,376	159,218	163,165	161,097
Vent Rate, SCFH	7,280	7,070	61,900	41,800	73,900	77,700
Bed Conditions						
Gas Velocity Inlet, ft/sec	1.76	1.87	2.61	2.70	2.97	2.98
Bed Density, lb/ft^3(4)	108	107	105	105	102	104
Average Bed Temperature, °F	1141	1188	1855	1680	1834	1870
Overhead Gas Analyses, Mol %						
O_2	0.0	0.0	0.0	0.0	0.0	0.0
CO	0.6	0.8	1.7	1.7	1.4	2.8
CO_2	9.6	15.0	18.5	12.8	18.0	16.0
N_2	89.8	84.2	79.8	85.5	80.6	81.2

(1) Determined by lift line pressure drop measurements
(2) Determined by weigh scale measurements
(3) Determined by orifice flow meter measurements
(4) Density indicated by pressure tap readings

Table 22-7. REGENERATOR DATA, RUN 22A

Date	11/27/74	← 11/28/74 →				11/29/74	
Time	1500	2300	0700	1500	2300	0700	1500
Jacket Steam Make, lb/hr	35	35	32	32	26	24	26
Solids							
Feedstock	← Husky Char →						Velva Lignite
Feed Rate, lb/hr[1]	1,390	860	1,360	2,420	1,660	1,410	1,410
Dump Acceptor, lb/hr	539	449	481	538	538	340	603
Purged Char, lb/hr	-	-	-	93	93	0	0
Gas Flows[2]							
Boot (Recycle), SCFH	40,000	23,900	27,200	25,700	30,000	25,800	19,500
Boot (Steam), SCFH	0	9,550	10,800	8,950	10,000	11,700	15,600
Steam to Side, SCFH	24,100	24,100	24,700	32,800	32,700	22,800	22,100
Air to Side, SCFH	14,900	15,200	15,600	15,000	13,800	14,600	15,000
Purges							
Recycle, SCFH	3,700	4,090	3,520	3,740	3,800	3,760	3,950
Inert, SCFH	387	387	387	387	387	387	387
Total Flow In, SCFH	83,087	77,227	82,207	86,577	90,687	79,041	76,537
Vent Rate, SCFH	31,300	37,500	27,900	40,000	31,000	32,600	34,600
Bed Conditions							
Boot Velocity, ft/sec	1.56	1.70	1.91	1.75	2.03	1.99	1.82
Char Bed Velocity Inlet, ft/sec	0.71	0.77	0.79	0.84	0.90	0.81	0.75
Boot Density, lb/ft^3[3]	90	98	98	92	99	98	99
Char Bed Density, lb/ft^3[3]	40	46	40	39	40	43	37
Boot Temperature, °F	1254	1425	1402	1412	1417	1509	1457
Char Bed Temperature, °F	1319	1467	1393	1412	1452	1509	1450
Overhead Gas Compositions, Mol %							
CO	6.0	16.0	8.0	11.0	14.0	18.0	14.4
CO_2	15.0	17.3	22.4	23.2	20.8	16.9	19.8
N_2	59.0	28.3	44.6	32.7	28.5	28.8	28.3
H_2	17.6	34.4	22.4	28.3	32.5	32.5	31.1
CH_4	2.4	4.0	2.9	4.8	4.3	3.9	6.3
H_2O Mol Fraction	23.4	26.2	34.0	33.8	30.9	24.0	28.4

(1)
(2) Determined by feeder RPM. PPH = 504*RPM-100
(3) Determined by orifice flow meter measurements
Determined by differential pressure measurements

Table 22-8. GASIFIER DATA, RUN 22B

Date	1/27/74		← 11/28/74 →			11/29/74	
Time	1500	2300	0700	1500	2300	0700	1500
Solids							
Acceptor Feedstock	← Dead-Burned Dolomite →						
Acceptor Makeup, lb/hr	327	727	327	327	327	363	363
Acceptor Circulation, lb/hr (1)	4,170	8,340	7,230	6,950	6,950	11,400	12,800
Ash & Attrited Acceptor, lb/hr (2)	100	39	39	78	67	80	114
Gas Flows (3)							
Acceptor Lift, SCFH	58,300	57,600	59,100	58,400	58,200	48,900	49,000
Char Lift, SCFH	7,630	7,660	7,660	7,550	7,580	7,600	7,560
Air Line							
Recycle, SCFH	66,400	53,000	55,400	50,600	33,600	27,300	43,100
Air, SCFH	15,100	56,600	15,400	32,800	56,700	51,700	49,400
Purges							
Recycle, SCFH	428	425	429	428	424	423	425
Inert, SCFH	1,480	1,480	1,480	1,480	1,480	1,480	1,480
Nitrogen, SCFH	1,690	1,320	1,690	1,690	1,680	1,660	1,690
Total Flow In, SCFH	151,028	178,085	141,159	152,948	159,664	139,063	152,655
Vent Rate, SCFH	19,400	68,000	24,800	40,200	68,800	60,000	58,600
Bed Conditions							
Gas Velocity Inlet, ft/sec	2.08	3.23	2.02	2.40	2.92	2.54	2.56
Bed Density, lb/ft^3 (4)	104	105	101	101	96	99	104
Average Bed Temperature, °F	1284	1824	1354	1522	1847	1854	1662
Overhead Gas Analyses, Mol %							
O_2	0.0	0.0	0.0	> 2.5	0.0	0.0	0.0
CO	0.9	4.5	0.3	0.0	2.5	3.6	3.0
CO_2	15.0	18.0	14.5	14.4	19.0	20.0	17.6
N_2	84.1	77.5	85.2	83.1	78.5	76.4	79.4

(1) Determined by lift line pressure drop measurements
(2) Determined by weigh scale measurements
(3) Determined by orifice flow meter measurements
(4) Density indicated by pressure tap readings

Table 22-9. REGENERATOR DATA, RUN 22B

Date	← 12/18/74 →			← 12/19/74 →			← 12/20/74 →		
Time	0800	1500	1900	0700	1500	2300	0700	1500	2300
Jacket Steam Make, lb/hr	0	0	0	0	0	0	0	0	0
Solids									
Feedstock	Husky Char	←			Velva Lignite		→		
Feed Rate, lb/hr(1)	1,920	1,710	1,410	1,660	1,920	2,170	1,920	2,670	1,440
Dump Acceptor, lb/hr	184	255	644	274	289	281	438	270	270
Purged Char, lb/hr	65	27	27	74	74	22	15	15	-
Gas Flows(2)									
Boot (Recycle), SCFH	22,200	19,200	19,700	20,900	16,300	17,700	18,100	21,100	14,000
Boot (Steam), SCFH	15,500	13,100	13,300	14,900	18,800	19,700	21,100	15,800	23,200
Boot (CO_2), SCFH	0	0	0	0	0	0	0	0	536
Steam to Side, SCFH	22,700	22,000	23,400	23,300	19,400	20,100	15,600	20,700	15,500
Air to Side, SCFH	14,500	14,900	14,600	14,900	15,200	15,200	9,010	14,800	0
Purges									
Recycle, SCFH	5,070	5,380	5,120	5,050	4,920	4,970	5,410	4,820	5,750
Inert, SCFH	387	387	387	387	387	387	387	387	387
Total Flow In, SCFH	80,357	74,967	76,507	79,437	75,007	78,057	69,607	77,607	59,373
Vent Rate, SCFH	36,200	55,600	56,100	51,000	57,900	56,400	45,000	40,200	23,900
Bed Conditions									
Boot Velocity, ft/sec	1.96	1.69	1.74	1.87	1.83	1.95	2.07	1.95	1.96
Char Bed Velocity Inlet, ft/sec	0.77	0.75	0.76	0.79	0.75	0.78	0.69	0.77	0.57
Boot Density, lb/ft^3(3)	104	102	101	102	110	107	102	101	96
Char Bed Density, lb/ft^3(3)	42	43	37	32	34	32	33	33	34
Boot Temperature, °F	1469	1483	1490	1467	1470	1475	1499	1495	1495
Char Bed Temperature, °F	1431	1511	1512	1491	1503	1499	1511	1495	1503
Overhead Gas Compositions, Mol %									
CO	13.4	17.2	17.0	18.0	18.1	17.6	16.4	16.0	13.6
CO_2	20.6	19.7	19.2	20.0	20.4	15.9	12.2	14.5	13.2
N_2	28.8	22.2	23.7	19.2	18.0	18.5	14.8	19.7	1.4
H_2	33.6	35.2	34.7	36.4	37.0	40.3	47.3	41.3	59.6
CH_4	3.6	5.5	5.4	6.4	6.5	7.7	9.3	8.6	12.1
H_2O Mol Fraction	31.5	29.6	29.0	28.8	30.0	27.0	26.8	27.4	37.2

(1) Determined by feeder RPM. PPH = 504*RPM-100
(2) Determined by orifice flow meter measurements
(3) Determined by differential pressure measurements

Table 22-10. GASIFIER DATA, RUN 22C

Date	← 12/18/74 →			← 12/19/74 →			← 12/20/74 →		
Time	0800	1500	1900	0700	1500	2300	0700	1500	2300
Jacket Steam Make, lb/hr	210	200	210	270	290	280	200	180	220
Solids	← Dead-Burned Dolomite →						Tymochtee Dolomite		
Acceptor Feedstock									
Acceptor Makeup, lb/hr	327	327	327	327	545	727	600	600	600
Acceptor Circulation, lb/hr[1]	7,880	12,400	13,100	12,100	16,300	12,200	11,400	9,550	11,700
Ash & Attrited Acceptor, lb/hr[2]	68	108	88	70	80	90	118	88	104
Gas Flows[3]									
Acceptor Lift, SCFH	59,600	58,500	59,000	59,000	52,100	51,500	51,300	51,100	51,100
Char Lift, SCFH	8,290	7,440	7,400	7,090	7,200	7,230	7,140	6,920	6,600
Air Line									
Recycle, SCFH	46,400	21,700	22,900	15,700	14,600	10,300	5,140	10,200	0
Air, SCFH	55,300	51,300	51,800	54,000	56,600	58,900	63,800	65,500	66,300
Purges									
Recycle, SCFH	425	422	423	423	423	419	416	416	415
Inert, SCFH	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480
Nitrogen, SCFH	2,350	1,920	2,040	1,810	1,160	970	1,080	810	710
Total Flow In, SCFH	173,845	142,762	145,093	139,503	133,563	130,799	130,356	136,426	126,605
Vent Rate, SCFH	76,700	67,200	66,100	71,400	70,700	75,800	87,900	90,800	90,700
Bed Conditions									
Gas Velocity Inlet, ft/sec	2.98	2.62	2.64	2.55	2.45	2.38	2.38	2.49	2.31
Bed Density, lb/ft^3[4]	98	101	104	98	99	96	95	89	83
Average Bed Temperature, °F	1708	1868	1845	1856	1857	1835	1847	1842	1841
Overhead Gas Analyses, Mol %									
O_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	6.1	1.3	2.5	2.8	1.0	3.1	2.4	1.7	1.1
CO_2	17.6	20.4	19.6	19.2	19.8	24.0	26.1	26.0	27.4
N_2	76.3	78.3	77.9	78.0	79.2	72.9	71.5	72.3	71.5

(1) Determined by lift line pressure drop measurements
(2) Determined by weigh scale measurements
(3) Determined by orifice flow meter measurements
(4) Density indicated by pressure tap readings

Table 22-11. REGENERATOR DATA, RUN 22C

Date	← 1/17/75 →			← 1/18/75 →			← 1/9/75 →			← 1/20/75 →		
Time	0700	1500	2300	0700	1500	2300	0700	1500	2300	0700	1500	2300
Jacket Steam Make, lb/hr	0	0	0	0	0	0	0	0	0	0	0	0
Solids												
Feedstock	Husky Char	←					Velva Lignite		→			
Feed Rate, lb/hr(1)	960	980	1,410	1,310	1,660	1,910	2,170	1,840	1,820	1,390	1,660	1,710
Dump Acceptor, lb/hr	450	450	640	590	590	460	610	400	330	160	470	470
Gas Flows(2)												
Boot (Recycle), SCFH	24,000	23,800	18,900	18,000	21,800	22,300	22,400	20,300	20,900	21,000	21,100	21,200
Boot (Steam), SCFH	9,100	9,790	17,200	17,700	16,100	17,200	16,400	19,900	19,500	18,700	19,500	19,700
Boot (CO_2), SCFH	0	0	0	0	0	0	0	481	476	464	464	481
Steam to Side, SCFH	23,200	22,900	24,700	19,800	24,100	21,900	22,000	21,400	21,800	23,300	28,200	28,000
Air to Side, SCFH	14,200	15,000	15,100	14,800	15,200	15,200	13,400	10,300	4,550	0	0	0
Purges												
Recycle, SCFH	3,400	3,380	3,510	3,560	3,520	3,570	4,880	3,840	4,050	4,660	4,340	5,580
Inert, SCFH	387	387	387	387	387	387	387	387	387	387	387	387
Total Flow In, SCFH	74,287	75,257	79,797	74,247	81,107	80,557	79,467	76,608	71,663	68,511	73,991	75,348
Vent Rate, SCFH	33,300	34,900	48,400	55,000	57,700	57,000	52,000	51,000	38,800	31,100	33,200	34,900
Bed Conditions												
Boot Velocity, ft/sec	0.92	1.62	1.79	1.81	1.90	2.00	1.99	2.11	2.13	2.09	2.16	2.15
Char Bed Velocity Inlet, ft/sec	0.57	0.72	0.79	0.74	0.81	0.80	0.78	0.77	0.72	0.68	0.74	0.73
Boot Density, lb/ft^3(3)	108	117	105	101	105	102	101	92	93	90	90	87
Char Bed Density, lb/ft^3(3)	50	43	43	39	39	39	37	39	41	43	46	40
Boot Temperature, °F	1408	1428	1483	1484	1487	1490	1529	1551	1519	1529	1515	1505
Char Bed Temperature, °F	1417	1429	1503	1495	1500	1499	1509	1544	1519	1530	1513	1502
Overhead Gas Compositions, Mol %												
CO	14.2	13.4	18.3	18.8	18.4	18.5	17.4	17.7	14.9	15.2	14.1	14.3
CO_2	25.9	16.6	15.3	15.4	18.4	16.6	13.8	13.4	13.5	12.6	13.7	9.9
N_2	29.2	38.7	29.5	25.1	22.5	22.4	20.5	17.3	11.2	4.8	2.8	3.7
H_2	26.5	27.5	33.2	35.0	34.7	35.5	40.3	43.8	49.4	55.6	56.6	58.1
CH_4	4.2	3.8	3.7	5.7	6.1	7.0	8.0	7.9	11.0	11.8	12.8	14.0
H_2O Mol Fraction	29.4	23.2	22.2	22.5	26.1	24.5	24.9	26.8	32.1	33.2	36.5	29.2

(1) Determined by feeder RPM. PPH = 504*RPM-100
(2) Determined by orifice flow meter measurements
(3) Determined by differential pressure measurements

Table 22-12. GASIFIER DATA, RUN 23 (Sheet 1 of 3)

Date	← 1/21/75 →			← 1/22/75 →			← 1/23/75 →			← 1/24/75 →		
Time	0700	1500	2300	0700	1500	2300	0700	1500	2400	0300	1500	2300
Jacket Steam Make, lb/hr	0	0	0	0	0	0	0	0	0	0	0	0
Solids												
Feedstock	← Velva Lignite →										Husky Char	
Feed Rate, lb/hr[1]	2,420	2,170	2,450	1,990	1,820	1,840	2,520	1,820	1,560	2,420	510	1,410
Dump Acceptor, lb/hr	350	430	230	350	180	400	240	350	540	500	270	270
Gas Flows[2]												
Boot (Recycle), SCFH	16,600	18,900	23,200	20,400	16,200	14,000	13,300	13,100	11,400	11,000	29,300	24,700
Boot (Steam), SCFH	24,800	19,900	19,500	24,300	25,200	29,600	30,200	31,000	31,200	31,400	9,200	11,900
Boot (CO_2), SCFH	479	477	513	539	510	499	500	0	0	0	0	0
Steam to Side, SCFH	25,200	25,800	23,300	26,200	26,100	20,000	20,700	19,400	20,100	20,100	20,200	30,200
Air to Side, SCFH	0	12,500	0	0	0	0	0	0	13,400	13,800	15,100	20,000
Purges												
Recycle, SCFH	6,150	5,640	6,530	6,790	6,740	6,630	6,670	6,470	5,670	5,470	4,900	5,560
Inert, SCFH	387	387	387	387	387	387	387	387	387	387	387	387
Total Flow In, SCFH	73,616	83,604	73,430	78,616	75,137	71,116	71,757	70,357	82,157	82,157	79,087	92,747
Vent Rate, SCFH	43,850	50,400	34,000	35,800	35,500	37,100	39,900	69,300	59,900	60,000	33,500	43,100
Bed Conditions												
Boot Velocity, ft/sec	2.11	1.99	2.20	2.22	2.19	2.14	2.11	2.04	1.95	1.92	1.94	1.87
Char Bed Velocity Inlet, ft/sec	0.69	0.78	0.69	0.73	0.72	0.65	0.65	0.62	0.75	0.75	0.77	0.91
Boot Density, lb/ft^3[3]	87	87	81	81	81	81	83	83	84	86	89	83
Char Bed Density, lb/ft^3[3]	40	41	39	41	41	41	41	42	44	46	47	43
Boot Temperature, °F	1497	1495	1478	1497	1514	1503	1488	1484	1470	1462	1436	1489
Char Bed Temperature, °F	1488	1488	1475	1496	1509	1506	1482	1490	1470	1464	1459	1483
Overhead Gas Compositions, Mol %												
CO	14.0	15.2	12.8	13.3	14.3	14.1	13.8	13.0	14.8	14.7	16.2	14.0
CO_2	9.4	11.7	8.6	8.0	8.6	9.2	9.1	11.0	13.6	14.8	7.7	18.7
N_2	7.1	19.2	3.8	3.9	3.2	2.9	3.0	3.0	14.5	17.8	35.8	30.6
H_2	55.5	44.1	57.6	60.4	60.2	60.2	58.1	59.2	48.1	44.1	36.0	32.7
CH_4	14.0	9.8	17.2	14.4	13.7	13.6	16.0	13.8	9.0	8.6	4.3	4.0
H_2O Mol Fraction	27.1	25.3	27.3	26.9	27.3	28.8	27.4	33.4	29.8	29.7	13.9	30.1

(1) Determined by feeder RPM. PPH = 504*RPM-100
(2) Determined by orifice flow meter measurements
(3) Determined by differential pressure measurements

Table 22-12. GASIFIER DATA, RUN 23 (Sheet 2 of 3)

Date	1/25/75		2/1/75		← 2/2/75 →			← 2/3/75 →			2/4/75
Time	0700	1500	1500	2300	0300	1500	2300	0700	1500	2300	0700
Jacket Steam Make, lb/hr											
Solids											
Feedstock	Velva Lignite		← Husky Char →			← Velva Lignite →				Husky Char	Velva Lignite
Feed Rate, lb/hr(1)	2,220	1,440	1,160	910	1,160	2,090	2,670	2,670	2,420	2,170	2,450
Dump Acceptor, lb/hr	230	230	680	680	54	120	390	410	54	54	54
Gas Flows(2)											
Boot (Recycle), SCFH	26,100	25,900	42,400	22,900	24,500	20,400	20,400	23,800	23,500	28,700	24,000
Boot (Steam), SCFH	12,700	20,800	0	18,300	18,800	18,600	18,700	20,000	20,600	19,400	18,700
Boot (CO_2), SCFH	0	0	0	0	0	445	445	410	413	439	450
Steam to Side, SCFH	29,600	36,500	22,700	22,600	31,500	30,900	31,300	32,000	28,800	30,800	32,300
Air to Side, SCFH	16,800	23,400	14,600	14,100	19,500	19,600	19,400	19,700	16,800	20,300	
Purges											
Recycle, SCFH	4,910	4,850	3,290	4,510	4,550	4,430	4,560	4,470	4,660	3,930	4,390
Inert, SCFH	387	387	387	387	387	387	387	387	387	387	387
Total Flow In, SCFH	90,497	111,837	83,377	82,797	99,237	94,762	95,192	100,767	95,160	103,956	80,227
Vent Rate, SCFH	54,100	62,200	16,100	40,100	58,200	72,000	59,500	81,800	71,300	58,900	67,900
Bed Conditions											
Boot Velocity, ft/sec	2.00	1.93	1.92	1.93	2.00	19.5	1.92	2.21	2.16	2.40	2.25
Char Bed Velocity Inlet, ft/sec	0.89	1.01	0.74	0.77	0.95	0.93	0.93	1.00	0.91	1.03	1.01
Boot Density, lb/ft^3(3)	80	80	84	87	84	81	80	80	78	81	77
Char Bed Density, lb/ft^3(3)	39	33	52	49	44	31	32	30	27	31	37
Boot Temperature, °F	1516	1442	1209	1395	1480	1505	1497	1517	1490	1475	1517
Char Bed Temperature, °F	1479	1436	1239	1420	1495	1495	1491	1508	1473	1474	1503
Overhead Gas Compositions, Mol %											
CO	15.1	12.6	6.5	13.6	15.5	17.8	18.6	20.4	18.2	17.1	15.7
CO_2	14.4	20.2	23.0	18.1	13.1	15.4	15.1	11.7	12.2	13.3	12.4
N_2	24.0	30.2	47.1	32.0	30.5	22.9	20.9	19.3	17.6	27.0	23.6
H_2	38.0	31.5	16.4	31.1	36.8	37.1	37.9	41.0	43.4	37.2	40.3
CH_4	8.5	5.5	7.0	5.2	4.1	6.8	7.6	7.6	8.6	5.4	8.0
H_2O Mol Fraction	26.2	31.2	24.7	26.5	23.9	24.5	23.6	19.6	22.0	21.9	24.6

(1) Determined by feeder RPM. PPH = 504*RPM-100
(2) Determined by orifice flow meter measurements
(3) Determined by differential pressure measurements

Table 22-12. GASIFIER DATA, RUN 23 (Sheet 3 of 3)

Date	← 1/17/75 →			← 1/18/75 →			← 1/19/75 →		
Time	0700	1500	2300	0700	1500	2300	0700	1500	2300
Jacket Steam Make, lb/hr[4]	250	300	270	220	330	300	300	230	280
Solids									
Acceptor Feedstock	← Dead-Burned Dolomite →					← Tymochtee Dolomite →			
Acceptor Makeup, lb/hr[1]	360	370	370	370	370	600	600	600	600
Acceptor Circulation, lb/hr[2]	8,710	11,800	12,500	12,500	13,000	12,900	12,700	10,700	10,400
Ash & Attrited Acceptor, lb/hr[3]	43	79	76	75	62	71	85	86	82
Gas Flows[4]									
Acceptor Lift, SCFH	57,900	58,200	57,800	57,900	57,700	57,300	56,900	56,500	56,500
Char Lift, SCFH	7,300	7,300	7,300	7,400	7,350	7,350	7,400	7,370	7,310
Air Line									
Recycle, SCFH	21,300	22,500	22,400	22,400	22,300	10,600	0	0	0
Air, SCFH	52,500	41,200	52,000	52,400	53,000	53,800	64,000	60,300	65,300
Purges									
Recycle, SCFH	428	428	425	426	424	420	418	415	415
Inert, SCFH	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480
Nitrogen, SCFH	877	1,400	1,160	1,720	1,690	1,660	1,570	1,500	1,020
Total Flow In, SCFH	141,785	132,508	142,565	143,726	143,944	132,610	131,768	127,565	132,025
Vent Rate, SCFH	66,900	54,800	62,200	62,000	63,700	72,800	84,000	82,100	89,200
Bed Conditions									
Gas Velocity Inlet, ft/sec	2.61	2.28	2.63	2.62	2.65	2.40	2.38	2.34	2.41
Bed Density, lb/ft^3[5]	87-120	88-120	85-115	81-117	81-114	79-112	76-112	64-103	70-103
Average Bed Temperature, °F	1862	1713	1862	1849	1868	1839	1830	1866	1848
Overhead Gas Analyses, Mol %									
O_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	4.7	4.7	1.7	1.4	2.7	2.7	4.3	1.0	1.7
CO_2	14.8	15.2	17.6	16.8	18.4	22.5	24.6	26.8	27.4
N_2	80.5	80.2	80.7	81.8	79.0	74.8	71.2	72.3	70.9

(1)
(2) Determined by feeder RPM for fresh acceptor - PPH = 300*RPM, for dead-burned dolomite - PPH = 367*RPM
(3) Determined by lift line pressure drop measurements
(4) Determined by weigh scale measurements
(5) Determined by orifice flow meter measurements
Density indicated by pressure tap readings

Table 22-13. REGENERATOR DATA, RUN 23 (Sheet 1 of 4)

Date	← 1/20/75 →			← 1/21/75 →			← 1/22/75 →		
Time	0700	1500	2300	0700	1500	2300	0700	1500	2300
Jacket Steam Make, lb/hr[4]	250	290	320	340	330	260	280	250	250
Solids									
Acceptor Feedstock	← Tymochtee Dolomite →								
Acceptor Makeup, lb/hr[1]	600	600	600	600	600	600	600	600	600
Acceptor Circulation, lb/hr[2]	11,900	10,600	8,270	10,400	2,730	8,000	9,200	9,200	9,230
Ash & Attrited Acceptor, lb/hr[3]	87	92	84	110	87	125	100	138	83
Gas Flows[4]									
Acceptor Lift, SCFH	56,500	56,500	57,100	57,200	56,600	57,200	57,000	56,900	56,400
Char Lift, SCFH	7,220	7,140	7,460	7,150	7,410	7,350	7,360	7,340	7,400
Air Line									
Recycle, SCFH	0	0	0	0	0	0	0	0	0
Air, SCFH	66,900	65,800	66,300	67,900	65,300	71,300	69,800	69,800	71,500
Purges									
Recycle, SCFH	415	415	413	414	414	414	413	413	413
Inert, SCFH	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480
Nitrogen, SCFH	1,120	1,070	1,000	1,020	1,000	1,190	930	930	1,000
Total Flow In, SCFH	133,635	132,405	133,753	135,164	132,204	138,934	136,983	136,863	138,193
Vent Rate, SCFH	91,900	88,900	90,000	96,700	88,200	98,400	97,200	93,200	96,100
Bed Conditions									
Gas Velocity Inlet, ft/sec	2.45	2.40	2.46	2.47	2.44	2.53	2.50	2.51	2.54
Bed Density, lb/ft^3[5]	67-100	64-97	63-94	64-97	61-96	60-91	60-91	61-90	58-90
Average Bed Temperature, °F	1858	1827	1861	1842	1866	1841	1843	1855	1860
Overhead Gas Analyses, Mol %									
O_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	1.9	2.8	1.8	2.6	3.5	4.6	2.3	2.0	2.1
CO_2	26.8	26.8	28.5	28.1	28.1	27.6	29.4	29.4	28.9
N_2	71.4	70.5	69.7	69.3	68.4	67.8	68.3	68.6	69.0

(1)
(2) Determined by feeder RPM for fresh acceptor - PPH = 300*RPM, for dead-burned dolomite - PPH = 367*RPM
(3) Determined by lift line pressure drop measurements
(4) Determined by weigh scale measurements
(5) Determined by orifice flow meter measurements
Density indicated by pressure tap readings

Table 22-13. REGENERATOR DATA, RUN 23 (Sheet 2 of 4)

Date	← 1/23/75 →			← 1/24/75 →			1/25/75	
Time	0700	1500	2400	0300	1500	2300	0700	1500
Jacket Steam Make, lb/hr[4]	250	260	290	330	320	330	280	310
Solids								
Acceptor Feedstock	←			Tymochtee Dolomite			→	
Acceptor Makeup, lb/hr[1]	600	600	900	1,200	1,200	435	600	300
Acceptor Circulation, lb/hr[2]	8,310	7,370	3,830	3,800	1,070	3,770	4,100	3,700
Ash & Attrited Acceptor, lb/hr[3]	117	90	98	118	57	104	101	75
Gas Flows[4]								
Acceptor Lift, SCFH	57,100	58,000	57,600	58,200	58,000	57,500	58,100	59,400
Char Lift, SCFH	7,270	7,330	7,330	7,270	7,260	7,340	7,350	7,330
Air Line								
Recycle, SCFH	0	0	0	0	50,700	33,500	0	29,200
Air, SCFH	75,100	66,700	61,400	62,700	44,600	57,000	49,400	34,100
Purges								
Recycle, SCFH	414	413	414	414	420	416	418	422
Inert, SCFH	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480
Nitrogen, SCFH	880	850	760	660	880	1,160	1,830	1,880
Total Flow In, SCFH	142,244	134,773	128,984	130,724	163,340	158,396	118,578	133,812
Vent Rate, SCFH	101,000	93,500	87,700	84,900	61,900	79,200	71,400	47,300
Bed Conditions								
Gas Velocity Inlet, ft/sec	2.62	2.46	2.37	2.41	2.88	2.83	2.15	2.32
Bed Density, lb/ft^3[5]	63-93	69-90	64-90	66-91	46-102	61-97	63-87	64-85
Average Bed Temperature, °F	1855	1845	1856	1856	1754	1787	1847	1737
Overhead Gas Analyses, Mol %								
O_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	4.0	2.1	2.6	2.2	1.6	2.6	3.6	1.7
CO_2	28.1	29.0	28.1	28.1	22.1	25.9	24.6	20.0
N_2	67.9	69.0	69.3	69.8	76.3	71.5	71.8	78.3

(1) Determined by feeder RPM for fresh acceptor - PPH = 300*RPM, for dead-burned dolomite - PPH = 367*RPM
(2) Determined by lift line pressure drop measurements
(3) Determined by weigh scale measurements
(4) Determined by orifice flow meter measurements
(5) Density indicated by pressure tap readings

Table 22-13. REGENERATOR DATA, RUN 23 (Sheet 3 of 4)

Date	← 2/1/75 →		← 2/2/75 →			← 2/3/75 →			2/4/75
Time	1500	2300	0300	1500	2300	0700	1500	2300	0700
Jacket Steam Make, lb/hr[4]	0	0	190	290	270	350	370	350	320
Solids									
Acceptor Feedstock	← Reconditioned Stone →				← Tymochtee Dolomite →				
Acceptor Makeup, lb/hr[1]	600	300	0	0	0	600	600	300	600
Acceptor Circulation, lb/hr[2]	4,290	6,250	5,930	8,320	11,600	12,800	8,710	4,940	8,930
Ash & Attrited Acceptor, lb/hr[3]	133	78	17	47	88	140	117	83	113
Gas Flows[4]									
Acceptor Lift, SCFH	58,700	56,200	56,700	56,400	56,000	55,500	55,700	56,400	55,800
Char Lift, SCFH	7,180	7,770	7,720	7,440	7,440	7,380	7,410	7,430	7,480
Air Line									
Recycle, SCFH	68,100	35,200	0	15,600	15,500	0	0	22,800	0
Air, SCFH	23,200	61,400	46,000	51,500	68,800	70,100	67,100	59,500	66,600
Purges									
Recycle, SCFH	429	418	417	416	415	412	414	416	410
Inert, SCFH	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480
Nitrogen, SCFH	1,880	1,020	1,160	1,730	1,810	1,640	1,310	1,280	1,380
Total Flow In, SCFH	160,969	163,488	113,477	134,566	151,445	136,512	133,414	149,306	133,150
Vent Rate, SCFH	24,100	84,000	68,600	69,300	93,900	99,300	93,600	72,000	94,700
Bed Conditions									
Gas Velocity Inlet, ft/sec	1.88	2.89	2.1	2.47	2.73	2.47	2.42	2.68	2.43
Bed Density, lb/ft^3[5]	88-99	73-103	81-106	72-100	76-108	72-103	72-100	66-100	66-96
Average Bed Temperature, °F	1014	1762	1870	1866	1824	1833	1829	1800	1852
Overhead Gas Analyses, Mol %									
O_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	1.1	3.7	2.2	2.2	3.1	2.2	3.1	3.5	2.0
CO_2	14.4	24.6	25.0	25.9	27.2	30.3	28.5	26.3	31.7
N_2	84.5	71.7	72.7	72.0	69.8	67.5	68.4	70.1	66.3

(1) Determined by feeder RPM for fresh acceptor - PPH = 300*RPM, for dead-burned dolomite - PPH = 367*RPM
(2) Determined by lift line pressure drop measurements
(3) Determined by weigh scale measurements
(4) Determined by orifice flow meter measurements
(5) Density indicated by pressure tap readings

Table 22-13. REGENERATOR DATA, RUN 23 (Sheet 4 of 4)

Date 9/19/74 - 9/26/74

	Dolomite		Lignite	
Screen Size, Wt % Tyler Mesh	Dead-Burned (Average)	Screen Size, Wt % Tyler Mesh	Husky Char (Average)	Velva
+9	0.3	+6		
9 X 12	37.8	6 X 8		
12 X 20	55.9	8 X 10		Tr
-20	6.1	10 X 14		6.8
		14 X 20	28.8	10.6
		20 X 28		15.2
		28 X 35		16.9
		35 X 48	51.5	18.8
		48 X 65		13.2
		65 X 100	14.0	10.3
		100 X 200		6.2
		-200	5.8	2.0
Ultimate Analysis, Wt %(1)				
Moisture(2)				1.36
C				63.31
H				4.20
S				1.14
Ash + SO_3				11.07
Elemental Analysis, Wt %				
SiO_2				26.86
SO_3				15.20
Na_2O				1.14

(1) Dry basis
(2) As received

Table 22-14. FEEDSTOCK COMPOSITES, RUN 22A

Date 11/26/74 - 11/29/74

	Dolomite		Lignite	
Screen Size, Wt % Tyler Mesh	Dead-Burned (1)	Screen Size, Wt % Tyler Mesh	Husky Char (Average)	Velva Composite
+4	0.1	+6		
4 X 6	Tr	6 X 8		
6 X 8	0.3	8 X 10	.2	Tr
8 X 9	0.7	10 X 14	4.4	6.8
9 X 10	8.7	14 X 20	12.7	10.6
10 X 12	28.1	20 X 28	25.0	15.2
12 X 14	32.4	28 X 35	23.5	16.9
14 X 16	18.8	35 X 48	17.1	18.8
16 X 20	7.1	48 X 65	8.1	13.2
20 X 24	2.0	65 X 100	4.6	10.3
24 X 28	1.0	100 X 200	3.0	6.2
-28	0.8	-200	1.5	2.0
Ultimate Analysis, Wt %(2)				
Moisture(3)				1.36
C				63.31
H				4.20
S				1.14
Ash + SO_3				11.07
Elemental Analysis, Wt %				
SiO_2				26.86
SO_3				15.20
Na_2O				1.14

(1) One sample
(2) Dry basis
(3) As received

Table 22-15. FEEDSTOCK COMPOSITES, RUN 22B

Date 12/17/74 - 12/24/74

	Dolomite			Lignite	
Screen Size, Wt % Tyler Mesh	Dead-Burned(1)	Tymochtee	Screen Size, Wt % Tyler Mesh	Husky Char	Velva
+4	0.2	Screen Not Available	+6	(Average)	0.25
4 X 6	0.2		6 X 8		9.2
6 X 8	5.5		8 X 10	22.4	10.5
8 X 9	32.3		10 X 14		13.2
9 X 10	27.3		14 X 20	48.6	15.8
10 X 12	14.0		20 X 28		18.2
12 X 14	10.2		28 X 35	16.2	12.5
14 X 16	1.6		35 X 48		10.2
16 X 20	0.5		48 X 65	12.8	7.0
20 X 24	8.2		65 X 100		3.3
24 X 28			100 X 200		
-28			-200		
Ultimate Analysis, Wt %(2)					
Moisture(3)					0
C					65.37
H					4.60
S					0.48
Ash + SO_3					10.21
Elemental Analysis, Wt %					
SiO_2		6.19			25.83
SO_3		0.62			10.12
Na_2O		0.07			1.14
CaO		56.74			38.05
MgO		37.26			13.24
K_2O		0.11			0.31
P_2O_5		0.02			0.14
Al_2O_3		1.54			9.13
Fe_2O_3		0.79			4.41
TiO_2		0.11			0.51

(1) Only one sample taken
(2) Dry basis
(3) As received

Table 22-16. FEEDSTOCK COMPOSITES, RUN 22C

Date 1/16/75 - 2/5/75

Screen Size, Wt % Tyler Mesh	Dolomite: Dead-Burned (Average)	Dolomite: Tymochtee	Screen Size, Wt % Tyler Mesh	Lignite: Husky Char (Average)	Lignite: Velva
+4			+6		
4 X 6			6 X 8		
6 X 8			8 X 10		
8 X 9	0.1	63.9	10 X 14		
9 X 10			14 X 20	23.7	27.4
10 X 12	20.1	32.6	20 X 28		
12 X 14			28 X 35		
14 X 16			35 X 48	53.2	51.3
16 X 20	65.0	3.5	48 X 65		
20 X 24			65 X 100	14.7	15.2
24 X 28	7.8	Tr	100 X 200		
-28	7.1	Tr	-200	8.4	6.1
Ultimate Analysis, Wt %(1)					
Moisture (as received)					0
C					64.87
H					3.97
S					0.52
Ash + SO_3				15.57	9.00
Elemental Analysis, Wt %					
SiO_2		5.98		26.57	28.74
SO_3		0.62		21.84	12.56
Na_2O		0.07			1.38
CaO		56.54			34.86
MgO		36.68			8.89
K_2O		0.13			0.36
P_2O_5		0.02			0.14
Al_2O_3		1.42			9.46
Fe_2O_3		0.80			4.56
TiO_2		0.10			0.44

(1) Dry basis

Table 22-17. FEEDSTOCK COMPOSITES. RUN 23

	Calcined Acceptor Return		Recarbonated Acceptor Return
Date	11/27/74	11/28/74	11/27/74
Time	0245	2000	0000
Screen Size, Wt % Tyler Mesh			
+4	0.1		
4 X 6	Tr		0.3
6 X 8	0.3	1.0	0.4
8 X 9	0.7	2.4	8.3
9 X 10	8.7	13.4	27.3
10 X 12	28.1	31.2	32.9
12 X 14	32.4	31.1	19.3
14 X 16	18.8	13.6	6.9
16 X 20	7.1	4.2	2.0
20 X 24	2.0	1.1	1.1
24 X 28	1.0	1.0	1.3
-28	0.8	1.1	

Table 22-18. CIRCULATED ACCEPTOR, RUN 22B

	Calcined Acceptor Return				Recarbonated Acceptor Return		
Date	12/19/74	← 12/20/74 →			← 12/19/74 →		
Time	2130	1000	1615	2200	0800	1600	2000
Screen Size, Wt % Tyler Mesh							
+4	2.1	5.4	4.4	3.6	0.5	0.5	0.3
4 X 6	3.0	9.8	9.0	6.7	1.2	1.3	1.1
6 X 8	12.9	19.5	19.0	15.9	8.5	12.2	10.7
8 X 9	32.9	29.1	27.1	25.0	30.9	30.5	31.0
9 X 10	26.0	20.5	21.1	21.0	31.2	29.2	30.2
10 X 12	11.5	8.4	10.7	11.4	17.1	16.4	16.1
12 X 14	5.1	3.3	4.2	5.1	8.0	7.4	7.8
14 X 16	1.2	0.8	1.0	1.4	1.4	1.4	1.5
16 X 20	0.8	0.8	0.9	1.5	0.8	0.7	0.4
20 X 24	4.4	2.3	2.1	8.1	0.3	0.4	1.0
24 X 28							
-28							

Table 22-19. CIRCULATED ACCEPTOR, RUN 22C

Date	1/18/75		← 1/19/75 →			← 1/20/75 →		
Time	1000	1600	0400	1600	2200	1000	1600	2200
Screen Size, Wt % Tyler Mesh								
+4								0.3
4 X 6								Tr
6 X 8	0.6		1.8	3.2	3.8	6.9	5.0	6.8
8 X 9	0.6	0.1	3.4	4.7	6.8	14.9	10.6	13.4
9 X 10	9.9	8.3	9.7	12.2	13.3	19.6	17.2	19.6
10 X 12	33.4	29.5	29.3	23.3	22.8	22.3	21.4	20.8
12 X 14	29.5	28.4	27.2	23.4	22.7	18.3	19.1	18.2
14 X 16	14.9	16.5	14.8	16.1	14.8	10.2	12.3	10.5
16 X 20	7.2	10.3	7.2	8.9	8.0	4.4	5.8	4.2
20 X 24	1.5	2.1	1.3	1.7	1.8	1.1	1.6	1.3
24 X 28	0.5	1.0	0.6	1.2	1.2	0.6	1.4	1.0
-28	1.8	3.7	4.7	5.2	4.6	1.8	5.3	3.9

Table 22-20. CIRCULATED ACCEPTOR, CALCINED ACCEPTOR RETURN, RUN 23 (Sheet 1 of 4)

Date	← 1/21/75 →			← 1/22/75 →			← 1/23/75 →		
Time	1000	1600	2200	1100	1535	2145	1000	1600	2140
Screen Size, Wt % Tyler Mesh									
+4									
4 X 6									
6 X 8	9.8	4.9	6.8	12.5	14.8	9.1	10.4	13.4	10.6
8 X 9	18.0	13.1	14.3	21.3	21.1	16.4	20.9	22.2	17.8
9 X 10	23.8	20.9	21.6	22.5	23.3	23.0	23.7	25.4	22.3
10 X 12	18.6	19.6	19.3	17.0	15.6	18.3	18.5	16.5	16.9
12 X 14	15.1	18.3	17.5	14.2	12.3	15.1	13.7	12.3	14.1
14 X 16	7.7	9.6	8.8	5.9	5.3	7.0	5.4	4.9	6.4
16 X 20	3.0	4.3	3.8	3.1	2.5	3.9	2.9	2.2	4.2
20 X 24	1.0	1.9	1.6	1.2	1.3	2.1	1.5	1.2	2.4
24 X 28	0.6	2.2	1.8	1.0	1.0	2.0	1.3	0.9	2.6
-28	2.4	5.3	3.8	1.4	2.8	3.2	1.8	1.0	2.8

Table 22-20. CIRCULATED ACCEPTOR, CALCINED ACCEPTOR RETURN, RUN 23 (Sheet 2 of 4)

Date	← 1/24/75 →			1/25/75		← 2/1/75 →		
Time	1000	1640	2200	0830	1605	1030	1600	2200
Screen Size, Wt % Tyler Mesh								
+4								
4 X 6								
6 X 8	6.8	7.2	6.7	4.3	10.8	5.0	6.5	6.3
8 X 9	16.0	14.4	15.2	12.5	19.5	18.8	18.4	12.6
9 X 10	21.5	18.2	22.2	22.8	23.9	26.6	28.8	18.5
10 X 12	18.1	16.0	20.3	19.7	18.5	21.3	25.2	25.5
12 X 14	15.6	14.5	13.9	13.6	12.0	10.8	12.1	19.3
14 X 16	8.1	7.0	6.0	7.6	6.1	5.2	4.0	10.7
16 X 20	6.7	6.0	4.6	6.3	4.4	3.8	2.0	5.7
20 X 24	4.7	4.0	2.8	3.7	2.2	1.8	0.8	0.9
24 X 28	1.4	4.3	2.7	2.9	1.4	1.7	0.6	0.3
-28	1.0	8.2	5.7	6.6	1.3	4.9	1.7	0.6

Table 22-20. CIRCULATED ACCEPTOR, CALCINED ACCEPTOR RETURN, RUN 23 (Sheet 3 of 4)

Date	2/2/75		← 2/3/75 →			2/4/75	
Time	1010	1600	0020	0845	1600	0000	0820
Screen Size, Wt % Tyler Mesh							
+4							
4 X 6							
6 X 8	2.4	3.5	1.8	6.1	6.6	3.3	5.9
8 X 9	9.1	11.2	8.4	13.2	16.3	13.7	15.0
9 X 10	20.1	22.3	20.4	24.0	24.9	23.3	26.0
10 X 12	28.5	28.2	27.7	24.5	22.3	21.6	21.8
12 X 14	19.0	18.6	20.1	16.9	15.6	15.8	16.1
14 X 16	10.8	8.4	10.4	7.7	8.1	9.6	8.6
16 X 20	6.8	4.3	6.5	3.7	3.6	4.8	3.3
20 X 24	1.5	1.0	1.5	1.0	0.9	1.9	1.1
24 X 28	0.7	0.6	0.7	0.6	0.6	1.8	0.8
-28	1.1	2.0	2.5	2.2	1.1	4.4	1.4

Table 22-20. CIRCULATED ACCEPTOR, CALCINED ACCEPTOR RETURN, RUN 23 (Sheet 4 of 4)

Date	1/17/75	← 1/18/75 →			← 1/19/75 →		
Time	0800	0800	1600	2000	0800	1600	2000
Screen Size, Wt %							
Tyler Mesh							
+4							
4 X 6							
6 X 8	0.6	0.5		0.1	2.5	2.5	2.3
8 X 9	0.6	0.6	0.1	0.3	4.4	4.9	5.4
9 X 10	5.6	6.9	4.7	5.1	9.8	11.4	12.3
10 X 12	24.8	22.1	24.1	27.2	25.0	25.5	22.2
12 X 14	27.9	28.8	28.8	29.9	25.5	24.9	24.4
14 X 16	20.3	21.8	21.6	19.9	17.1	16.6	16.5
16 X 20	14.6	14.7	15.0	12.8	11.1	9.6	10.1
20 X 24	3.9	3.2	3.2	2.5	2.2	2.0	2.2
24 X 28	1.1	1.0	1.2	1.0	1.1	1.1	1.6
-28	0.7	0.4	1.3	1.3	1.4	1.6	3.1
Particle Density, lb/cu ft		203.4			187.3	185.0	189.1
% Calcine Weight Change		-0.2			-4.2	-5.9	
Activity		0.02			0.17	0.16	0.13
Elemental Analysis, Wt %							
S=		0.04			0.05		
SiO_2		1.66			3.46	4.61	4.36
SO_3		0.01			0.23	0.07	0.02

Table 22-21. CIRCULATED ACCEPTOR, RECARBONATED ACCEPTOR RETURN, RUN 23 (Sheet 1 of 5)

Date	← 1/20/75 →			← 1/21/75 →		
Time	0800	1600	2000	0400	1600	2000
Screen Size, Wt %						
Tyler Mesh						
+4						
4 X 6						
6 X 8	3.7	3.5	3.5	3.9	3.2	4.4
8 X 9	7.6	9.2	10.9	10.7	10.9	12.8
9 X 10	17.6	17.3	19.0	19.2	20.7	21.6
10 X 12	22.3	22.5	21.6	20.0	21.7	21.2
12 X 14	21.5	21.8	21.3	19.8	20.6	18.5
14 X 16	15.0	14.0	12.8	12.5	11.5	10.2
16 X 20	7.3	6.9	5.5	5.6	4.9	4.4
20 X 24	1.7	1.9	1.6	2.3	2.0	2.0
24 X 28	1.3	1.9	1.7	2.3	2.1	2.1
-28	1.9	1.0	1.9	3.7	2.4	2.7
Particle Density, lb/cu ft	181.9	180.9	166.4	159.6	166.5	153.6
% Calcine Weight Change	-6.3	-6.4	-7.1	-8.6	-8.4	-10.2
Activity	0.17	0.15	0.19	0.22	0.25	0.26
Elemental Analysis, Wt %						
S=	0.05			0.04		
SiO_2	4.21	5.50	4.07	5.41	5.98	6.28
SO_3	0.03	0.22	0.10	0.06	0.66	0.45

Table 22-21. CIRCULATED ACCEPTOR, RECARBONATED ACCEPTOR RETURN, RUN 23 (Sheet 2 of 5)

Date	← 1/22/75 →			← 1/23/75 →		
Time	0800	1500	2000	0800	1600	2000
Screen Size, Wt %						
Tyler Mesh						
+4						
4 X 6						
6 X 8	4.8	5.5	6.2	6.2	5.0	4.3
8 X 9	13.0	16.6	16.3	15.8	13.7	12.6
9 X 10	20.6	23.6	23.3	22.3	22.0	21.3
10 X 12	19.4	18.6	18.4	19.2	17.4	19.2
12 X 14	17.8	16.8	16.7	15.4	16.0	16.1
14 X 16	8.7	7.5	7.2	7.0	8.0	7.5
16 X 20	4.8	4.1	4.2	4.6	5.3	5.8
20 X 24	2.7	2.4	2.1	2.8	3.7	3.6
24 X 28	3.4	2.4	2.4	3.0	3.7	4.3
-20	5.0	2.6	3.3	3.8	5.3	5.2
Particle Density, lb/cu ft	146.6	157.2	157.2	151.0	154.4	153.4
% Calcine Weight Change	-8.8	-8.5	-8.5	-9.1	-10.7	-10.1
Activity	0.26	0.25	0.26	0.26	0.29	0.28
Elemental Analysis, Wt %						
S=	0.08			0.08		
SiO_2	6.53	6.81	7.28	7.76	7.32	8.75
SO_3	0.24	0.17	0.37	0.48	0.10	0.77

Table 22-21. CIRCULATED ACCEPTOR, RECARBONATED ACCEPTOR RETURN, RUN 23 (Sheet 3 of 5)

Date	← 1/24/75 →			1/25/75		2/1/75	
Time	0400	1600	2000	0800	1600	1600	2000
Screen Size, Wt %							
Tyler Mesh							
+4							
4 X 6							
6 X 8	6.9	7.9	5.9	8.2	7.9	4.0	4.9
8 X 9	16.9	16.7	14.8	16.2	15.9	12.0	13.1
9 X 10	22.8	22.9	23.2	25.4	22.8	21.1	20.2
10 X 12	18.4	18.0	21.5	20.8	19.0	26.4	24.8
12 X 14	14.7	14.4	15.0	12.3	12.9	17.9	17.0
14 X 16	6.9	6.4	6.7	6.3	6.7	9.2	9.3
16 X 20	5.0	5.4	5.4	4.8	6.1	6.6	7.3
20 X 24	3.1	3.3	3.2	2.8	3.7	1.7	2.0
24 X 28	2.8	2.8	3.0	2.0	3.1	0.7	0.9
-28	2.6	2.2	1.4	1.3	1.9	0.6	0.6
Particle Density, lb/cu ft	150.5	158.5	158.8	146.8	150.8		
% Calcine Weight Change	-13.9	-14.1	-11.5	-8.0	-12.3		
Activity	0.36	0.36	0.29	0.28	0.36		
Elemental Analysis, Wt %							
S=	0.02			0.5			
SiO_2	6.57	6.87	8.88	7.00	8.29		
SO_3	0.47	0.59	1.02	2.07	1.04		

Table 22-21. CIRCULATED ACCEPTOR, RECARBONATED ACCEPTOR RETURN, RUN 23 (Sheet 4 of 5)

Date	← 2/2/75 →			← 2/3/75 →			2/4/75
Time	0830	1600	2000	0800	1600	2000	0810
Screen Size, Wt %							
Tyler Mesh							
+4							
4 X 6							
6 X 8	1.1	0.9	1.1	2.5	3.7	2.0	3.7
8 X 9	5.6	4.4	6.5	8.1	11.5	8.0	12.0
9 X 10	15.4	14.2	16.9	17.1	20.4	17.8	22.5
10 X 12	26.9	24.5	25.1	23.3	21.3	20.6	19.6
12 X 14	21.4	22.0	21.6	20.1	18.3	19.8	18.9
14 X 16	15.1	15.7	14.1	13.4	12.6	15.5	12.1
16 X 20	10.1	12.2	10.0	8.5	6.9	8.8	5.3
20 X 24	2.3	3.0	2.4	2.2	2.0	2.7	2.2
24 X 28	0.9	1.2	1.1	1.4	1.5	2.3	1.9
-28	1.3	1.8	1.4	3.3	1.8	2.6	1.9
Particle Density, lb/cu ft	173.2	169.3		173.8			162.0
% Calcine Weight Change	-3.7			-4.8			-7.2
Activity	0.08	0.19	0.11	0.15	0.20	0.18	0.19
Elemental Analysis, Wt %							
S=	0.10			0.03			0.02
SiO_2	3.31			4.43			5.92
SO_3	0.52			0.21			0.37

Table 22-21. CIRCULATED ACCEPTOR, RECARBONATED ACCEPTOR RETURN, RUN 23 (Sheet 5 of 5)

Date	9/26/74	9/26/74	9/26/74
Time	0800	1200	1730
Screen Size, Wt %			
Tyler Mesh			
+6			
6 X 8	Tr		
8 X 10	0.1	Tr	0.4
10 X 14	31.8	24.9	26.4
14 X 20	18.3	15.1	16.2
20 X 28	9.1	8.5	8.7
28 X 35	11.2	11.7	11.2
35 X 48	12.1	14.7	14.1
48 X 65	7.8	10.2	9.4
65 X 100	6.2	8.9	8.2
100 X 200	2.8	5.1	4.5
-200	0.5	0.9	0.8
% Char	37.6	49.2	54.0
Ash + SO_3	19.18	19.86	19.49
Ash Elemental Analysis, Wt %			
SiO_2	27.01	24.39	23.06
SO_3	6.62	6.49	5.63
Na_2O	2.20	1.89	1.60

*Samples taken from gasifier char bed

Table 22-22. REGENERATOR FUEL CHAR,* RUN 22A

Date	11/26/74	← 11/28/74 →			← 11/29/74 →		
Time	2155	0000	0800	1200	0030	0800	1600
Screen Size, Wt % Tyler Mesh							
+6							
6 X 8		0.1				Tr	
8 X 10	0.6	1.4	1.8	1.8	1.8	1.9	1.8
10 X 14	21.8	18.4	23.0	20.9	19.6	26.6	18.8
14 X 20	20.9	14.5	13.8	13.7	16.2	15.2	13.4
20 X 28	17.2	13.4	10.5	11.9	13.9	9.9	10.3
28 X 35	13.7	14.8	12.9	13.3	14.0	12.0	14.3
35 X 48	10.7	14.4	13.7	13.7	13.1	12.6	15.7
48 X 65	6.6	8.4	8.8	8.1	7.6	8.0	9.4
65 X 100	4.7	7.3	6.2	8.0	6.7	7.1	8.9
100 X 200	2.7	5.3	6.9	6.0	5.0	4.9	5.7
-200	1.0	2.0	2.4	2.5	2.1	1.7	1.7
% Char	71.2	67.9	58.5	73.5	61.8	55.4	59.9
Ash + SO_3	12.9	17.09	21.75	18.49	12.33	22.59	19.32
Ash Elemental Analysis, Wt %							
SiO_2	20.38		25.68			25.69	23.27
SO_3			7.13			12.39	10.23
Na_2O			2.55			2.52	2.45

*Samples taken from the gasifier char bed

Table 22-23. REGENERATOR FUEL CHAR,* RUN 22B

Date	12/18/74	12/19/74		← 12/20/74 →		
Time	1200	1300	2000	0400	1200	2000
Screen Size, Wt %						
Tyler Mesh						
+6						
6 X 8	0.2		Tr	1.1	0.5	0.9
8 X 10	1.9	2.0	1.3	3.6	2.6	5.4
10 X 14	24.9	28.3	21.9	21.1	16.8	18.7
14 X 20	17.3	13.8	15.0	13.2	11.6	11.4
20 X 28	12.9	7.1	10.0	10.2	10.6	11.1
28 X 35	12.9	9.6	12.6	12.6	14.3	14.0
35 X 48	11.5	12.8	15.3	14.4	16.7	15.3
48 X 65	6.6	8.8	9.1	8.8	10.0	9.1
65 X 100	5.8	9.2	7.4	7.8	8.6	7.3
100 X 200	4.3	6.7	5.5	5.3	6.1	5.0
-200	1.7	1.7	1.8	2.1	2.1	1.8
% Char	60.2	46.3	53.7	56.2	69.3	70.8
Ash + SO_3	17.71	15.23	16.19	13.88	17.22	13.21
Ash Elemental Analysis, Wt %						
SiO_2	21.61	27.50		21.99	22.33	17.68
SO_3	12.89	2.53		2.82	3.47	4.30
Na_2O	2.02	1.52		1.28	1.49	1.16

*Samples taken from gasifier char bed.

Table 22-24. REGENERATOR FUEL CHAR,* RUN 22C

Date	← 1/18/75 →				← 1/19/75 →			
Time	1200		2000		0400		1200	
Fraction	Char	Acceptor	Char	Acceptor	Char	Acceptor	Char	Acceptor
Screen Size, Wt %								
Tyler Mesh								
+6		↓		↓		↓		↓
6 X 8					0.6		1.4	
8 X 10			0.4		1.8		3.9	
10 X 14	22.6	32.8	22.1	33.5	21.5	34.5	23.2	42.2
14 X 20	18.8	49.5	18.4	45.6	16.7	41.0	15.0	37.4
20 X 28	6.9	4.6	6.6	5.2	7.7	5.4	6.8	4.5
28 X 35	8.9	3.6	9.1	4.4	10.0	6.7	9.3	5.6
35 X 48	14.5	4.7	14.4	5.7	14.6	7.2	13.5	6.2
48 X 65	10.2	3.6	10.5	4.2	10.3	3.8	9.6	3.1
65 X 100	9.7	1.0	9.7	1.2	9.4	1.2	9.1	0.8
100 X 200	6.9	0.2	6.6	0.2	5.8	0 2	6.2	0.1
-200	1.5	0.0	2.1	0.0	1.7	Tr	1.9	0
% Char	45.3		47.6		50.9		46.0	
Ash + SO_3	19.50		17.36		12.53		12.68	
Ash Elemental Analysis, Wt %								
SiO_2	26.34		24.76		23.76		24.71	
SO_3	3.7		2.70		3.21		4.12	
Na_2O	1.49		1.87		1.46		1.68	

*Samples taken from gasifier char bed

Table 22-25. REGENERATOR FUEL CHAR,* RUN 23 (Sheet 1 of 8)

Date	← 1/19/75 →				← 1/20/75 →			
Time	2000		0400		1100		2000	
Fraction	Char	Acceptor	Char	Acceptor	Char	Acceptor	Char	Acceptor
Screen Size, Wt %								
Tyler Mesh								
+6								
6 X 8	1.6	↓	2.0	↓	2.1	↓	2.8	↓
8 X 10	6.5		6.8		8.2		10.4	
10 X 14	24.7	50.6	24.9	49.2	28.2	48.2	27.4	48.4
14 X 20	15.0	33.2	14.5	31.0	13.6	31.1	13.2	28.8
20 X 28	7.4	4.3	7.4	5.1	6.2	5.5	7.9	6.1
28 X 35	9.7	5.1	9.8	6.5	8.3	6.4	9.7	7.3
35 X 48	13.0	4.3	12.9	5.7	11.6	6.0	11.6	6.8
48 X 65	8.6	2.1	8.5	2.0	8.3	2.3	7.1	2.1
65 X 100	8.1	0.5	7.4	0.4	7.5	0.5	6.0	0.5
100 X 200	4.3	0.1	4.6	0.1	4.7	0.2	3.3	Tr
-200	1.2	Tr	1.2	Tr	1.2	0	0.6	Tr
% Char	34.2		42.6		32.1		40.5	
Ash + SO_3	13.6		12.43		15.16		13.70	
Ash Elemental Analysis, Wt %								
SiO_2	18.30		18.76		19.08		17.74	
SO_3	1.64		1.41		1.20		3.78	
Na_2O	1.34		1.33		1.59		1.87	

*Samples taken from gasifier char bed

Table 22-25. REGENERATOR FUEL CHAR,* RUN 23 (Sheet 2 of 8)

Date	← 1/22/75 →				← 1/23/75 →			
Time	2000		0400		1200		2000	
Fraction	Char	Acceptor	Char	Acceptor	Char	Acceptor	Char	Acceptor
Screen Size, Wt %								
Tyler Mesh								
+6								
6 X 8	2.7		3.2		2.8		2.7	
8 X 10	12.7		13.3	1.4	11.4		11.7	
10 X 14	20.9	49.2	22.7	58.6	18.5	47.4	21.3	51.8
14 X 20	9.7	20.7	9.0	18.6	8.4	19.3	9.1	19.6
20 X 28	10.2	9.5	8.8	7.6	10.1	10.3	10.1	10.0
28 X 35	12.1	10.2	10.4	7.2	11.9	11.6	11.9	10.0
35 X 48	13.5	7.7	12.1	5.1	13.8	9.0	13.9	6.4
48 X 65	7.3	2.4	7.0	1.4	8.3	2.4	7.7	2.1
65 X 100	6.2	0	6.9	0.3	7.9	0	6.9	0
100 X 200	4.0	0	5.0	0	5.6	0	3.6	0
-200	0.8	0.2	1.7	0	1.2	0	1.0	0.1
% Char	39.0		33.2		44.5		41.3	
Ash + SO_3	17.30		12.50		14.81		12.15	
Ash Elemental Analysis, Wt %								
SiO_2	16.48		18.56		24.04		16.65	
SO_3	2.73		2.97		2.63		3.05	
Na_2O	1.11		1.20		1.42		1.14	

*Samples taken from gasifier char bed

Table 22-25. REGENERATOR FUEL CHAR,* RUN 23 (Sheet 3 of 8)

Date	← 1/24/75 →				← 1/25/75 →			
Time	0400		1015		2000		0400	
Fraction	Char	Acceptor	Char	Acceptor	Char	Acceptor	Char	Acceptor
Screen Size, Wt %								
Tyler Mesh								
+6								
6 X 8	3.3	↓	2.0	↓	1.3	↓	2.3	↓
8 X 10	15.4		8.3		5.2		7.7	
10 X 14	19.8	47.5	13.2	36.5	14.6	39.7	18.0	41.1
14 X 20	9.0	20.2	7.4	19.5	10.8	15.6	11.8	16.2
20 X 28	9.9	11.3	14.2	12.9	15.7	15.1	15.4	12.6
28 X 35	11.6	11.3	16.1	17.1	17.7	10.8	16.0	16.9
35 X 48	12.9	7.5	16.7	10.3	16.5	14.8	13.8	9.9
48 X 65	7.2	2.3	8.7	3.7	7.0	4.1	5.9	2.7
65 X 100	6.5	0	7.2	0	5.5	0	4.6	0
100 X 200	3.4	0	4.0	0	4.3	0	3.5	0
-200	1.2	0	1.8	0	1.4	0	1.0	0.7
% Char	39.3		81.1		54.3		50.6	
Ash + SO_3	10.85		5.68		18.11		16.94	
Ash Elemental Analysis, Wt %								
SiO_2	26.05		24.40		26.22		25.32	
SO_3	3.35		4.54		15.39		17.56	
Na_2O	1.52		1.77		2.85		2.87	

*Samples taken from gasifier char bed

Table 22-25. REGENERATOR FUEL CHAR,* RUN 23 (Sheet 4 of 8)

Date	← 1/25/75 →				2/1/75		2/2/75	
Time	1200		2000		2000		0400	
Fraction	Char	Acceptor	Char	Acceptor	Char	Acceptor	Char	Acceptor
Screen Size, Wt %								
Tyler Mesh								
+6								
6 X 8	2.6		1.4				0.8	
8 X 10	9.5		3.9		4.9		4.8	
10 X 14	13.2	40.5	7.3	28.4	12.2	59.7	20.7	38.9
14 X 20	8.5	14.9	7.9	12.7	8.7	29.6	14.8	46.4
20 X 28	12.6	11.9	14.5	17.9	8.8	4.7	11.2	6.7
28 X 35	15.2	17.6	18.1	21.6	10.0	2.6	13.1	3.2
35 X 48	15.5	11.2	18.1	12.9	10.3	2.0	13.9	3.0
48 X 65	8.0	3.1	9.9	4.6	6.2	1.1	8.4	1.4
65 X 100	7.3	0.7	8.7	0	4.7	0.4	6.7	0.5
100 X 200	5.7	0	7.2	0	33.5	0	4.1	0
-200	1.9	0	3.0	0	0.7	0	1.5	0
% Char	44.3		63.1		60.6		61.8	
Ash + SO_3	14.68		14.63		15.84		19.89	
Ash Elemental Analysis, Wt %								
SiO_2	31.16		24.73		22.77		24.10	
SO_3	6.12		2.30		11.44		11.17	
Na_2O	2.64		1.77		2.00		2.18	

*Samples taken from gasifier char bed

Table 22-25. REGENERATOR FUEL CHAR,* RUN 23 (Sheet 5 of 8)

Date	← 2/2/75 →				← 2/3/75 →			
Time	1230		2000		0400		1200	
Fraction	Char	Acceptor	Char	Acceptor	Char	Acceptor	Char	Acceptor
Screen Size, Wt %								
Tyler Mesh								
+6								
6 X 8	0.3		0.5		0.6		0.6	
8 X 10	2.3		2.9		4.4		4.4	
10 X 14	15.0	35.8	18.1	48.8	18.9	35.2	15.3	41.9
14 X 20	11.7	29.0	13.7	32.3	11.6	39.6	12.0	27.2
20 X 28	10.3	7.5	9.8	4.5	7.4	7.0	9.8	7.2
28 X 35	13.8	7.3	12.6	4.8	10.2	6.7	13.4	9.0
35 X 48	16.3	9.0	15.4	4.6	13.6	6.8	16.1	9.0
48 X 65	10.8	7.1	10.4	3.5	9.9	3.7	10.2	4.3
65 X 100	10.0	2.5	9.0	1.5	9.8	0.9	8.5	1.4
100 X 200	7.2	0	6.0	0	8.2		6.2	0
-200	2.3	1.9	1.6	Tr	5.4		3.6	0
% Char	69.4		53.6		64.8		65.9	
Ash + SO_3	11.17		13.84		17.62		16.68	
Ash Elemental Analysis, Wt %								
SiO_2	21.67		21.31		27.56		19.20	
SO_3	12.04		4.97		2.67		3.77	

*Samples taken from gasifier char bed

Table 22-25. REGENERATOR FUEL CHAR,* RUN 23 (Sheet 6 of 8)

Date	2/3/75		2/4/75	
Time	2030		0400	
Fraction	Char	Acceptor	Char	Acceptor
Screen Size, Wt %				
Tyler Mesh				
+6				
6 X 8	0.5		1.0	
8 X 10	3.3		7.6	
10 X 14	12.6	47.3	19.4	47.9
14 X 20	9.7	20.2	12.5	25.7
20 X 28	10.2	6.3	12.2	5.4
28 X 35	14.0	11.4	13.3	13.2
35 X 48	16.5	8.4	13.5	5.2
48 X 65	10.5	4.5	8.1	2.1
65 X 100	9.35	1.8	6.3	0.5
100 X 200	7.8	0	3.9	0
-200	5.4	0	2.2	0
% Char	73.4		52.4	
Ash + SO_3	15.70		18.61	
Ash Elemental Analysis, Wt %				
SiO_2	21.70		25.25	
SO_3	1.86		12.88	
Na_2O			1.88	

*Samples taken from gasifier char bed

Table 22-25. REGENERATOR FUEL CHAR,* RUN 23 (Sheet 7 of 8)

Date	← 1/21/75 →				← 1/22/75 →			
Time	0400		2000		0400		1100	
Fraction	Char	Acceptor	Char	Acceptor	Char	Acceptor	Char	Acceptor
Screen Size, Wt %								
Tyler Mesh								
+6		↓		↓		↓		↓
6 X 8	2.2		2.6		2.4		2.6	
8 X 10	8.2		11.7		12.5		12.5	
10 X 14	26.1	52.9	23.0	48.1	23.5	56.3	20.3	46.9
14 X 20	11.1	26.5	9.4	24.2	9.5	19.9	9.0	21.5
20 X 28	7.6	6.4	7.6	8.1	8.2	8.2	9.2	8.2
28 X 35	10.0	7.1	10.4	9.3	11.2	8.2	12.2	10.5
35 X 48	13.0	5.4	13.2	7.3	12.7	6.1	13.7	9.3
48 X 65	8.3	1.5	8.0	2.6	7.2	1.2	7.8	3.5
65 X 100	7.6	0.3	7.5	0.3	6.7	0.2	6.9	0
100 X 200	4.9	Tr	5.1	0	4.7	0	4.8	0
-200	1.0	0	1.4	0	1.3	0	1.0	0
% Char	36.6		40.7		36.6		41.9	
Ash + SO_3	13.53		17.77		15.25		18.69	
Ash Elemental Analysis, Wt %								
SiO_2	20.25		14.06		23.34		23.79	
SO_3	1.47		1.82		2.37		2.49	
Na_2O	1.41		1.30		1.38		1.24	

*Samples taken from gasifier char bed

Table 22-25. REGENERATOR FUEL CHAR,* RUN 23 (Sheet 8 of 8)

Date	9/26/74
Time	2100 Composite
Screen Size, Wt %	
Tyler Mesh	
+60	0.5
60 X 100	15.2
100 X 325	26.0
-325	58.3
Ultimate Analysis, Wt %	
H_2O	0
C	60.46
H	2.04
S	0.71
Ash + SO_3	30.66
Elemental Analysis, Wt %	
SiO_2	25.76
SO_3	7.70
Na_2O	1.21

Table 22-26. GASIFIER CHAR TO ORGANIC POND, RUN 22A

Date	12/20/74	12/21/74
Time	Composite	Composite
Screen Size, Wt %		
Tyler Mesh		
+60		41.9
60 X 100		42.9
100 X 325		13.6
-325		1.7
Ultimate Analysis, Wt %		
H_2O	0	0
C	64.25	60.42
H	1.05	0.99
S	0.62	1.03
Ash + SO_3	27.75	33.63
Elemental Analysis, Wt %		
SiO_2	29.76	31.35
SO_3	8.32	10.83
Na_2O	1.10	1.49

Table 22-27. GASIFIER CHAR TO ORGANIC POND, RUN 22C

Date	1/19/75		1/21/75		1/22/75
Time	0000	2400	0000	2400	2400
Screen Size, Wt %					
Tyler Mesh					
+60	0	17.2	0.5	Tr	Tr
60 X 100	2.1	41.0	31.2	2.3	2.8
100 X 325	60.7	20.7	49.9	48.0	40.3
-325	37.3	21.0	18.4	49.7	56.9
Ultimate Analysis, Wt %					
H_2O				0.45	0.99
C	61.49	61.74	63.0	59.70	57.82
H	1.09	1.34	1.95	4.43	1.09
S (Total)	1.09	0.52	1.22	0.17	0.68
Ash + SO_3	32.07	27.27	28.14	27.73	32.86
Elemental Analysis, Wt %					
SiO_2	29.54	29.48	27.70	29.17	30.58
SO_3	8.56	5.54	5.86	4.85	5.41
Na_2O	1.50	1.44	1.14	1.47	1.67

Table 22-28. GASIFIER CHAR TO ORGANIC POND (COMPOSITE), RUN 23 (Sheet 1 of 2)

Date	1/23/75	1/24/75	1/25/75	2/3/75	2/4/75
Time	0000	2330	2300	0000	0000
Screen Size, Wt %					
Tyler Mesh					
+60	0	Tr	Tr	Tr	0
60 X 100	0	3.8	1.0	Tr	0
100 X 325	15.4	48.4	43.6	43.5	86.4
-325	84.7	47.8	55.4	56.4	13.6
Ultimate Analysis, Wt %					
H_2O	0.64			1.19	4.32
C	72.14	58.99	34.08	58.70	53.97
H	2.57	1.06	4.55	1.09	1.58
S (Total)	0.83	1.20	1.24	1.51	1.14
Ash + SO_3	32.11	31.61	34.08	33.80	33.86
Elemental Analysis, Wt %					
SiO_2	26.20	31.32	31.93	30.16	25.35
SO_3	6.98	10.00	9.10	9.17	6.83
Na_2O	0.80	1.21	1.69	1.40	10.5

Table 22-28. GASIFIER CHAR TO ORGANIC POND (COMPOSITE), RUN 23 (Sheet 2 of 2)

Date	9/26/74	9/26/74
Time	0510	1300
Screen Size, Wt %		
Tyler Mesh		
+35	4.0	2.7
35 X 48	25.6	15.3
48 X 65	29.4	25.5
65 X 100	21.3	24.2
100 X 200	11.8	14.9
200 X 325	2.9	5.0
-325	5.0	12.5
% Calcine Weight Change	-64.2	-26.6
Elemental Analysis, Wt %		
SiO_2	19.45	42.60
SO_3	7.00	3.70
Na_2O	1.22	1.87

Table 22-29. ASH AND ATTRITED ACCEPTOR, RUN 22A

Date	11/27/74		11/28/74		11/29/74	
Time	1030	1750	0700	2210	0515	1740
Screen Size, Wt %						
Tyler Mesh						
+35	0.7	1.1	1.3	2.2	0.9	2.9
35 X 48	15.7	17.9	7.1	12.1	5.2	9.3
48 X 65	26.6	30.0	12.4	15.1	11.4	11.8
65 X 100	20.5	26.0	14.5	15.4	15.4	14.6
100 X 200	12.2	15.9	19.3	19.5	23.4	20.0
200 X 325	3.9	3.1	12.1	11.3	13.0	11.2
-325	20.4	6.0	33.3	24.4	30.9	30.1
% Calcine Weight Change		-65.8		-47.7		
Elemental Analysis, Wt %						
SiO_2		26.58		28.67		
SO_3		5.78		4.76		
Na_2O		1.20		1.65		

Table 22-30. ASH AND ATTRITED ACCEPTOR, RUN 22B

Date	← 12/18/74 →			12/19/74		12/20/74	
Time	1030	1345	2030	1100	1830	0730	1900
Screen Size, Wt %							
Tyler Mesh							
+35	1.6	3.0	0.7	0.9	0.4	0.2	0.2
35 X 48	8.4	4.8	3.3	6.3	4.0	2.6	5.8
48 X 65	14.5	7.5	7.0	11.9	9.2	6.7	12.0
65 X 100	18.2	10.3	12.6	14.9	14.1	12.2	15.3
100 X 200	20.9	21.6	26.5	22.4	24.3	22.6	21.2
200 X 325	9.6	15.9	18.2	12.0	14.0	21.0	12.2
-325	26.9	36.9	31.8	31.6	34.0	34.7	33.1
% Calcine Weight Change				-6.2	-3.9	-3.7	-0.5
Elemental Analysis, Wt %							
SiO_2				39.45	34.89	30.31	38.46
SO_3				2.70	1.15	2.91	2.69
Na_2O				1.62	1.30	1.21	2.1

Table 22-31. ASH AND ATTRITED ACCEPTOR, RUN 22C

Date	1/17/75		1/18/75		← 1/19/75 →			
Time	0930	1800	0515	1830	0130	0930	1700	2335
Screen Size, Wt %								
Tyler Mesh								
+35	5.3	1.3	0.4	0.6	0.8	0.3	0.7	0.5
35 X 48	19.6	7.3	4.0	5.2	5.6	3.3	3.5	3.0
48 X 65	23.4	14.0	9.6	11.7	11.9	10.8	8.8	7.1
65 X 100	20.5	20.7	16.3	16.4	14.7	18.6	13.3	10.9
100 X 200	15.7	23.2	22.9	20.8	19.7	35.4	21.2	22.4
200 X 325	5.0	10.5	13.6	12.9	12.3	26.5	18.8	28.6
-325	10.5	22.9	33.3	32.3	35	5.0	33.5	27.5
% Calcine Weight Change				-4.2	-5.5	-1.0	-0.7	-2.1
Elemental Analysis, Wt %			*					
SiO_2				35.10	38.00	29.30	28.29	24.64
SO_3				4.02	0.89	3.82	5.2	0.89
Na_2O				1.77	1.47	1.48	1.36	1.22
CaO			33.19					
MgO			13.24					
K_2O			0.27					
P_2O_5			0.08					
Al_2O_3			10.15					
Fe_2O_3			3.57					
TiO_2			0.37					

*Daily composite

Table 22-32. ASH AND ATTRITED ACCEPTOR, RUN 23 (Sheet 1 of 4)

Date	← 1/20/75 →			1/21/75		1/22/75	
Time	0930	1330	1930	0830	2000	0040	0830
Screen Size, Wt %							
Tyler Mesh							
+35	0.7	3.5	1.6	0.8	0.5	0.5	0.2
34 X 48	2.9	3.6	2.5	4.9	3.2	1.8	2.8
48 X 65	6.4	7.5	6.4	10.2	8.3	3.8	6.2
65 X 100	9.8	10.7	9.5	12.6	12.1	5.0	9.9
100 X 200	19.9	19.6	18.9	23.1	19.6	6.8	21.2
200 X 325	28.3	15.9	19.1	13.4	15.2	5.4	19.0
-325	32.1	39.2	41.9	35.1	41.1	76.8	40.7
% Calcine Weight Change			-1.0	-1.9	-3.4	-9.1	-0.6
Elemental Analysis, Wt %							
SiO_2	20.29		19.27	25.39	25.05	17.68	24.12
SO_3	5.11		4.79	1.07	7.70	3.30	3.10
Na_2O	0.98		1.20	1.30	1.42	0.74	0.95

Table 22-32. ASH AND ATTRITED ACCEPTOR, RUN 23 (Sheet 2 of 4)

Date	← 1/23/75 →			← 1/24/75 →			1/25/75	
Time	0130	1000	1600	0100	1000	2300	1030	2000
Screen Size, Wt %								
Tyler Mesh								
+35	2.2	2.0	3.4	3.5	4.5	1.2	0.2	0.2
35 X 48	4.8	6.8	4.7	4.5	4.3	9.4	3.0	4.4
48 X 65	8.0	10.4	7.6	7.2	7.3	16.1	8.0	10.9
65 X 100	10.9	11.7	10.5	10.2	10.9	18.6	12.5	16.5
100 X 200	19.0	19.2	18.9	20.3	20.0	20.6	20.0	22.0
200 X 325	14.6	10.0	13.2	17.1	13.1	0.5	13.5	13.0
-325	40.5	39.9	41.8	37.3	39.8	33.5	42.8	33.1
% Calcine Weight Change	+1.2	-1.9	+0.4	-0.2	-2.6	-18.1	+2.7	-15.2
Elemental Analysis, Wt %								
SiO_2	27.23	29.59	25.58	22.49	23.53	35.70	27.86	32.68
SO_3	6.21	3.82	5.72	4.83	17.30	6.88	9.79	4.41
Na_2O	0.99	0.99*	1.11	0.90	0.88	2.31	2.23*	1.96
CaO		37.43*					33.24*	
MgO		15.77					12.54	
K_2O		0.41					0.32	
P_2O_5		0.10					0.11	
Al_2O_3		9.46					10.01	
Fe_2O_3		3.82					3.17	
TiO_2		0.42					0.36	

*Daily composite

Table 22-32. ASH AND ATTRITED ACCEPTOR, RUN 23 (Sheet 3 of 4)

Date	2/1/75		2/2/75		2/3/75		2/4/75
Time	1600	1945	0320	1840	0630	1800	0230
Screen Size, Wt %							
Tyler Mesh							
+35	1.2	2.7	3.6	1.3	10.2	1.1	5.5
35 X 48	10.4	22.5	10.7	4.8	5.9	3.5	8.1
48 X 65	26.3	30.8	17.2	10.5	9.2	7.4	12.3
65 X 100	24.5	20.9	18.3	14.2	10.5	10.4	11.9
100 X 200	14.7	10.7	13.4	21.1	17.2	19.2	15.4
200 X 325	5.0	2.8	1.0	13.1	14.7	18.4	11.3
-325	18.0	9.6	35.8	35.1	32.4	40.0	35.5
% Calcine Weight Change						-2.5	
Elemental Analysis, Wt %			*		*		*
SiO_2						34.44	
SO_3						2.87	
Na_2O						1.05	
CaO			32.46		35.28		37.06
MgO			10.54		13.96		15.99
K_2O			0.22		0.40		0.38
P_2O_5			0.11		0.11		0.11
Al_2O_3			10.89		8.72		9.23
Fe_2O_3			4.54		2.99		2.96
TiO_2			0.52		0.31		0.35

*Daily composite

Table 22-32. ASH AND ATTRITED ACCEPTOR, RUN 23 (Sheet 4 of 4)

RUNS 24 AND 25

FEBRUARY 21 TO APRIL 10, 1975

CO_2 ACCEPTOR PROCESS GASIFICATION

PILOT PLANT

RAPID CITY, SOUTH DAKOTA

1 SUMMARY

This report covers the Rapid City Pilot Plant operations for Run 24 (February 21 to March 14, 1975) and Run 25 (March 31 to April 10, 1975).

The objective of Run 24 was to obtain data at steady-state plant conditions with 100 percent steam flow to the gasifier boot. Prior to startup, a methodical program for the removal of air and recycle gas from the gasifier was formulated in an attempt to avoid the high gasifier bed densities characteristic of previous runs and to enhance the stability of the gasifier boot control.

The initial startup for Run 24 was interrupted by the formation of an iron-nickel sulfide deposit in the acceptor lift gas heater coil which necessitated depressuring of the plant and replacing the coil. The plant was repressured on March 5, 1975, and a total of seven days of operation at temperature were achieved with no process problems encountered. The utilization of the char withdrawal system controlled the accumulation of intermediate fines at an operable and essentially constant level over the final four days of the run. The methodical program for the adjustment of the gasifier flows to achieve the target conditions of 100 percent steam and zero air in the gasifier inlet gas resulted in the smoothest plant operation achieved to date. Termination of the run occurred when the inlet to the gasifier quench tower plugged with a char ash derived mortar-type deposit.

At the end of the run, the gasifier inlet flow (excluding purge gas) contained 70 percent steam, 13 percent air, and 17 percent recycle gas. Had the run continued, a step-wise exchange of steam for recycle gas in the gasifier would have followed the removal of air.

To avoid the plugging problem which ended Run 24, a larger (4-inch) nozzle was installed at the inlet to the gasifier quench tower. Also, the quench water flow rate to the gasifier venturi upstream of the quench tower was increased to prevent entrained fines from adhering to the walls of the section between the venturi and the quench tower.

Run 25 started on March 31, 1975, with the same objective as Run 24. The run continued for five days after process conditions were reached. Again the methodical approach to removing air from the gasifier and replacing boot recycle gas with steam was being used. When the run ended, 67 percent of the air flow to the gasifier had been removed, steam flow to the gasifier boot reached 70 percent of the total boot flow, and the acceptor activity had reached 0.18.

The problem of plugging at the inlet of the gasifier quench tower still remained and caused several pressure upsets which in turn caused instability of the regenerator fuel char standleg. The run ended when the acceptor lift line plugged while attempts were being made to recover from a loss of fuel char transfer.

2 TEST DATA

Runs 24 and 25 data are presented tabularly at the end of this run report. These tables include:

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3 SIGNIFICANT EVENTS AND OBSERVATIONS

3.1 RUN 24

3.1.1 Objective

The primary objective of Run 24 was to obtain steady-state data with the acceptor providing 100 percent of the heat required for gasification and with 100 percent of the gasifier inlet gas being steam.

3.1.2 Accomplishments

Although the primary objective of Run 24 was not achieved, the systematic operating guidelines which were formulated prior to startup resulted in the smoothest plant operation ever achieved. The run logged a total of 150 hours of trouble-free operation at process conditions.

3.1.3 Problems

(1) Char removal system. During the first part of the run, switching the char removal hoppers would temporarily upset fuel char transfer to the regenerator. As the run progressed, operating techniques were devised which reduced the frequency of upsets due to switching the hoppers.

(2) Gas quench systems. Restrictions formed at the inlets to both the gasifier and the regenerator quench towers which necessitated rodding the inlets at least once per shift.

(3) Lignite grinding system. Lignite grinding was plagued with plugging problems during most of the run. The roller mill, mill lift line, and the Sweco screen were areas where most of the plugging occurred.

(4) Accumulation of intermediate fines. The problem of accumulating intermediate fines in the gasifier bed which surfaced during Run 21 was effectively controlled by utilizing the char withdrawal system.

3.1.4 Termination Cause

The formation of a plug at the inlet of the gasifier quench tower prevented the venting of product gases and necessitated an immediate shutdown of the plant.

3.1.5 Modifications and Changes Made Prior to Run 25

(1) Installed a venturi scrubber upstream of the gas inlet to the gasifier quench tower during the first Run 24 shutdown.

(2) A 4-inch inlet nozzle was installed on the gasifier quench tower, and the venturi was repositioned immediately upstream of this new nozzle during the second shutdown.

(3) The second venturi was reinstalled parallel to the original venturi upstream of the regenerator quench tower.

3.2 RUN 25

3.2.1 Objective

The objective of Run 25 was essentially the same as for Run 24: Obtain heat and material balance data at steady-state plant conditions with 100 percent steam to the gasifier and acceptor supplying 100 percent of the heat required for gasification.

3.2.2 Accomplishments

As in Run 24, the systematic procedure used to remove air from the gasifier bed and the replacing of recycle gas in the gasifier boot with steam proved to be highly successful from a process standpoint. The run logged a total of 121 hours at process conditions.

3.2.3 Problems

(1) Char removal system. The char removal system continued to intertupt fuel char feed to the regenerator throughout most of Run 25. The interruptions usually occurred after switching from one lockhopper to the other parallel lockhopper.

(2) Gas quench systems. Several times during the run, the inlets to both the regenerator and the gasifier quench towers became restricted causing pressure surges which usually interrupted fuel char flow to the regenerator. The gas inlets to both quench towers were rodded at least once per shift.

3.2.4 Termination Cause

Run 25 was terminated when the acceptor lift line plugged.

3.3 SUMMARIZED CHRONOLOGY OF OPERATIONS

3.3.1 Run 24

Run 24 was initiated on February 21 but was aborted two days later when the acceptor lift gas flow appeared to be restricted. The restriction was found to be an iron-nickel sulfide deposit in the acceptor lift gas heater coil. The heater coil was replaced and Run 24 was again initiated on March 5, 1975. The regenerator was filled with dead-burned dolomite, and acceptor circulation tests were conducted to establish the integrity of the solids circulation loop. Char was then added to the gasifier while circulating dead-burned dolomite at a low rate, and the char-acceptor interface was established without any problems. Fuel char transfer to the regenerator and char withdrawal from the gasifier bed were established followed by replacement of char feed with Velva lignite feed on March 7. When the system was stabilized on lignite feed, 6 X 9 mesh Tymochtee dolomite makeup replaced dead-burned dolomite makeup on March 9.

The run proceeded smoothly for seven days at temperature until the process gas inlet line to the gasifier quench tower plugged on March 14. Because the gasifier vent was downstream of the quench system, the unit had to be depressured immediately using the ESD-2 system to prevent overpressuring of the gasifier.

The plug occurred at a 4-inch by 2-inch bell reducer ahead of the 2-inch gas inlet nozzle on the gasifier quench tower. A large chunk of scale separated from the wall of the 4-inch line between the venturi and the quench tower inlet nozzle and lodged in the reducer at the quench tower inlet nozzle.

3.3.2 Run 25

The plant was pressure tested for Run 25 on March 31, 1975. The initial startup was interrupted on April 2 when the acceptor lift line plugged while filling the regenerator with dead-burned dolomite. This plug was a result of defluidizing the regenerator while removing air from the regenerator gas loop prior to adding char to the gasifier. The plant was depressured and both the gasifier boot and the regenerator were dumped. On April 3, dead-burned acceptor was again introduced to the unit and startup procedures resumed.

Acceptor circulation tests were run and char was introduced to the gasifier on April 4. The plant was brought to operating conditions and lignite feed started on April 5. Fresh 6 X 9 dolomite replaced the dead-burned acceptor makeup on April 6. The plant continued to run for five days as programmed adjustments were made. Several upsets were experienced due to pressure surges caused by restrictions at the inlet to the gasifier quench tower and operation of the char withdrawal system, both of which led to instability of the regenerator fuel char standleg.

On the afternoon of April 9, a pressure surge which was attributed to a restriction at the gasifier quench tower inlet caused a loss of fuel char feed to the regenerator.

To prevent oxygen breakthrough in the regenerator after loss of fuel char feed, air was quickly removed and replaced with recycle gas. Unfortunately, a portion of the regenerator flue gas was being used to fluidize the lignite preheater. The removal of air decreased the amount of flue gases available for preheater fluidization. Since the flue gas was not withdrawn from the preheater as fast as the air was removed from the regenerator, the regenerator partially depressured. This caused a safety interlock to close the boot interface level control valve which caused the acceptor level to build up into the transition section of the gasifier where it became defluidized and apparently agglomerated. Efforts to recover from this situation ultimately resulted in a plug in the acceptor lift line which terminated the run.

4 RESULTS AND DISCUSSION

4.1 BACKGROUND

Runs 24 and 25 were conducted with the main objective of demonstrating plant operation using only steam as the gasifier boot fluidizing gas. Previous attempts to achieve this objective failed because of two major factors, namely, high bed density and instability of the gasifier boot. Experience of previous runs revealed that high gasifier bed densities are the result of the accumulation of intermediate fines in the gasifier bed and that instability of the gasifier boot is most predominant during the critical changeover period when recycle gas to the gasifier boot is being replaced with steam.

The changes in operating procedure which were first implemented in Run 24 were aimed at stabilizing the entire gasifier operation by reducing the fluctuation of several operating parameters. The parameters which most severely affect the stability of the gasifier operation are the intermediate fines inventory, boot gas velocity, acceptor circulation rate, and lignite feed rate. The constraints placed on these parameters were as follows:

(1) Maintain char withdrawal rate from the gasifier bed at 100 to 200 pounds per hour. Data from previous runs indicated that a rate of 100 pounds per hour would limit the accumulation of intermediate fines which would in turn reduce the gasifier bed density.

(2) Maintain a minimum gas velocity of about 2 feet per second in the gasifier boot. In previous runs the boot velocity was lowered to near incipient while replacing the recycle gas with steam.

(3) Minimize acceptor circulation rate changes. It was decided to decrease the acceptor circulation rate if the gasifier bed temperature exceeded 1510^{o}F. The circulation rate would be increased only if the gasifier bed temperature was below 1520^{o}F and the bed density was below 35 pounds per cubic feet.

(4) Minimize lignite feed rate changes. The lignite feed rate was to be decreased slightly when the gasifier bed level reached 24 feet and increased slightly when the bed level fell to 21 feet.

By implementing these changes in operating techniques, the experience of Runs 24 and 25 clearly demonstrated that the problems of high gasifier bed density and boot interface stability could be controlled.

4.2 ACCOMPLISHMENTS

4.2.1 Operational Achievements

The following summary lists the operational achievements for Runs 24 and 25.

SUMMARY OF PLANT OPERATIONS

Run	Hours At Process Conditions	Hours With Lignite Feed	Hours With Fresh Acceptor Makeup	Hours Without Air In Gasifier
24	150	137	120	0
25	121	89	80	0

4.2.2 Plant Data

Tables 24-1 through 24-16 summarize the data obtained from Runs 24 and 25. Process operating conditions for the gasifier and the regenerator are shown in Tables 24-1 through 24-4. Analyses of typical feedstocks are presented in Tables 24-5 and 24-6, while analyses of effluent and circulated materials are presented in Tables 24-7 through 24-16. No attempt was made to calculate a heat or material balance for Runs 24 or 25 since neither run had reached steady-state conditions before termination.

4.3 PROBLEMS

4.3.1 Fuel Char Feed to the Regenerator

Interruptions of fuel char feed to the regenerator during both Runs 24 and 25 occurred primarily because of pressure surges in the char standleg. These pressure surges evolved from two sources. The most severe pressure surges occurred when a restriction at the gas inlet to either the regenerator or the gasifier quench tower would break either by the increasing pressure drop or by operation of the mechanical rod out. The second source of pressure surges was the operation or switching of one of the two parallel char removal hoppers.

More frequent operation of the rod outs on the quench systems reduced the magnitude of the pressure surges. Inspection of both the regenerator and the gasifier venturis after Run 24 shutdown revealed that solids were plating out on the walls of the diverging sections and downstream piping which indicated that the water flow was not large enough to sufficiently wet the solids and carry them into the quench tower.

4.3.2 Quench Systems

The initial startup of Run 24 was aborted shortly after the gasifier was filled with char because of a restriction in the acceptor lift gas heater. Inspection after shutdown revealed an iron-nickel sulfide deposit which necessitated replacing the coil.

During this shutdown, one of the two regenerator quench tower venturis was removed and placed upstream of the gas inlet to the gasifier quench tower. This was done as an expedient for two reasons; first, the regenerator quench system had been operating relatively trouble free after the prior installation of a second cyclone separator in series upstream of the regenerator quench tower; and second, another venturi scrubber could not be immediately obtained.

After the second startup of Run 24, the gasifier and the regenerator quench systems continued to interrupt operation of the plant. Run 24 ended when the 2-inch nozzle between the gasifier venturi scrubber and the quench tower plugged.

Between Runs 24 and 25, a larger 4-inch nozzle was installed on the gasifier quench tower and the venturi scrubber was installed vertically immediately upstream of this nozzle. A horizontal rod out for this nozzle was also installed. The old 2-inch nozzle was converted to a bypass for the venturi scrubber to be used in the event the venturi became plugged and while the horizontal rod out was being used. A second venturi scrubber for the regenerator was also fabricated and reinstalled during this shutdown.

The problem of restrictions forming at both the regenerator and the gasifier quench towers still persisted during Run 25 although operation of the rod outs prevented the restrictions from hampering operations severely.

The restrictions which formed during Run 25 appeared to be carbonate scale. Plans are to change the quench water to both the gasifier venturi and the regenerator venturi from potable water to boiler feed water containing an additive (possibly Betz 403) to prevent the formation of carbonate scale at the venturi throat.

4.3.3 Acceptor Lift Line Erosion

Hot spots formed on the outer shell of the acceptor lift line (CD-208) near each of the two internal slip joints during Run 24. Inspection after shutdown revealed that these hot spots were the result of insulation voids. The conical transition section of the lower slip joint was also opened for inspection and found to be eroded. Most of the erosion occurred in the base metal at the boundary between the Stellite overlay and the base metal. The entire transition cone was replaced.

During Run 25 hot spots formed on the bottom section of the lift line just above the engager pot and near the emergency valve, XCV-2010, on the top section. Both hot spots were found to be the result of insulation voids. A seven foot section of the inner liner above the engager pot was replaced because of thinning of the walls.

4.3.4 Lignite Grinding Section

Prior to Run 24 a motor with gear reducer was installed on the lignite roller mill to reduce the mill speed and thereby reduce the amount of fines produced in the grinding operation. Reduction of mill speed from 102 RPM to 56 RPM reduced the amount of fines produced but greatly increased the amount of oversize product. This caused the plugging problems encountered during the earlier part of Run 24. When the mill speed was increased to 60 RPM, the plugging problems were eliminated and the amount of fines produced was kept at a minimum during the remainder of Run 24.

The lignite grinding section performed very well during all of Run 25. A grinding rate of 4,100 pounds per hour of product was attained while maintaining the minus 100 mesh fines level in the product at less than 2 percent.

5 FUTURE PLANS

The inability to sustain long-term operation has been, in part, a result of instability in two critical areas of the plant. These are: (1) the fuel char standleg and char removal hoppers; and (2) the gasifier quench system. Runs 24 and 25 both promising from the standpoint of process performance, ended as a result of problems occurring in these areas.

Immediate plans are to exert a concentrated effort to improve the reliability of operation in these critical areas. Tests have been scheduled in which the gasifier venturi will be operated at atmospheric pressure to determine the optimum water injection configuration and flow rate. Also, a study of possible carbonate scale inhibitors which could be injected with the quench water has been initiated.

In addition to mechanical revisions to the fuel char standleg which were listed under paragraph 3.2.5 of this report, a study on line stability versus plant pressure balance conditions will be initiated. Tests are also scheduled to determine the optimum char lift line gas velocity in the existing fuel char lift line.

The program for Run 26 will be the same as that for Run 25. The major objectives will be to obtain heat and material balance data with no recycle gas in the gasifier inlet gas and to achieve long-term plant operations.

Date	3/7	3/7	3/8	3/8	3/8	3/9	3/9
Time	1500	2300	0700	1500	2300	0700	1500
Jacket Steam Make, lb/hr	0	0	0	0	0	0	0
Solids							
Feedstock	← Husky Char →				← Velva Lignite →		
Feed Rate, lb/hr[1]	1,240	1,240	1,240	1,330	1,720	1,910	2,450
Dump Acceptor, lb/hr					115	115	575
Char Withdrawal, lb/hr			240	100	100	200	70
Gas Flows[2]							
Boot (Recycle), SCFH	38,800	41,700	19,400	21,900	22,500	22,400	22,300
Boot (Steam), SCFH	0	0	17,600	21,500	21,500	19,600	19,100
Steam to Side, SCFH	23,300	23,200	24,000	34,000	33,100	33,900	33,700
Air to Side, SCFH	0	14,800	14,800	20,500	20,200	20,400	20,500
Purges							
Recycle, SCFH	4,000	3,300	3,500	3,600	3,900	4,000	4,400
Inert, SCFH	230	230	230	230	230	230	230
Total Flow In, SCFH	66,300	83,200	79,500	101,700	101,400	100,500	100,200
Vent Rate, SCFH	3,900	24,900	33,100	57,200	63,000	71,600	74,400
Bed Conditions							
Boot Velocity, ft/sec	1.46	1.92	1.98	2.15	2.23	2.20	2.18
Char Bed Velocity Inlet, ft/sec	.46	.77	.78	1.01	1.02	1.03	1.02
Boot Density, lb/ft^3[3]	114	110	105	102	96	101	102
Char Bed Density, lb/ft^3[3]	40	45	48	46	44	35	32
Boot Temperature, °F	992	1236	1307	1440	1460	1460	1459
Char Bed Temperature, °F	899	1311	1315	1451	1479	1479	1477
Overhead Gas Compositions, Mol %							
O_2	0	0	0	0	0	0	0
CO	0.0	9.1	8.3	14.9	16.7	18.5	18.2
CO_2	8.7	17.3	20.3	16.7	15.1	14.2	14.6
N_2	89.8	48.5	39.2	30.2	29.3	24.6	24.1
H_2	.8	20.4	26.6	34.2	35.0	36.6	36.3
CH_4	.7	4.7	5.6	4.0	3.9	6.1	6.8
H_2O Mol Fraction[4]	-	20.9	30.9	26.2	23.6	21.6	22.1

(1)
(2) Determined by feeder RPM (Rate = RPM X 484 + 267)
(3) Determined by orifice flow meter measurements
(4) Density indicated by pressure tap readings
Calculated using gasifier bed temperature and assuming water-gas shift equilibrium

Table 24-1. GASIFIER DATA, RUN 24 (Sheet 1 of 3)

Date	3/10	3/10	3/10	3/10	3/11	3/11	3/11
Time	0010	1100	1500	2300	0700	1500	2300
Jacket Steam Make, lb/hr	0	0	0	0	0	0	0
Solids							
Feedstock	←			Velva Lignite			→
Feed Rate, lb/hr[1]	2,690	2,200	2,490	2,740	2,740	2,740	2,740
Dump Acceptor, lb/hr	575	230	230	380	220	470	410
Char Withdrawal, lb/hr	100	140	105	180	85	125	115
Gas Flows[2]							
Boot (Recycle), SCFH	23,600	23,800	23,200	21,500	21,400	19,800	17,100
Boot (Steam), SCFH	20,400	20,800	22,400	24,700	24,900	27,500	29,900
Steam to Side, SCFH	33,500	32,200	30,500	29,000	29,900	28,600	25,000
Air to Side, SCFH	20,100	19,900	18,600	15,400	15,600	15,800	15,600
Purges							
Recycle, SCFH	3,800	3,700	3,800	4,000	4,100	4,500	4,800
Inert, SCFH	230	230	230	230	230	230	230
Total Flow In, SCFH	101,600	100,600	98,700	94,800	96,100	96,400	92,600
Vent Rate, SCFH	54,500	82,000	82,800	68,900	68,300	69,800	65,000
Bed Conditions							
Boot Velocity, ft/sec	2.30	2.40	2.32	2.36	2.42	2.39	2.34
Char Bed Velocity Inlet, ft/sec	1.05	1.05	1.00	0.96	0.99	0.97	0.91
Boot Density, lb/ft	99	98	98	93	90	87	87
Char Bed Density, lb/ft	37	30	32	35	39	36	36
Boot Temperature, °F	1482	1497	1500	1498	1516	1509	1501
Char Bed Temperature, °F	1504	1510	1510	1506	1521	1515	1502
Overhead Gas Compositions, Mol %							
O_2	0	0	0	0	0	0	0
CO	18.8	16.5	18.5	17.8	17.9	16.7	17.5
CO_2	11.6	12.5	10.3	9.6	7.4	10.7	9.7
N_2	22.8	26.6	25.0	19.5	20.1	19.1	19.2
H_2	39.0	38.0	39.0	44.1	45.6	44.6	44.3
CH_4	7.8	6.4	7.2	9.0	9.0	8.9	9.3
H_2O Mol Fraction[4]	19.8	23.0	18.4	19.7	16.7	23.1	20.1

(1) Determined by feeder RPM (Rate = RPM X 484 + 267)
(2) Determined by orifice flow meter measurements
(3) Density indicated by pressure tap readings
(4) Calculated using gasifier bed temperature and assuming water-gas shift equilibrium

Table 24-1. GASIFIER DATA, RUN 24 (Sheet 2 of 3)

Date	3/12	3/12	3/12	3/13	3/13	3/13	3/14	3/14
Time	0700	1500	2300	0700	1500	2300	0700	1500
Jacket Steam Make, lb/hr	0	0	0	0	0	0	0	0
Solids								
Feedstock	← Velva Lignite →							
Feed Rate, lb/hr[1]	2,740	2,200	2,060	2,540	2,590	2,590	2,450	2,450
Dump Acceptor, lb/hr	340	120	400	275	380	120	120	390
Char Withdrawal, lb/hr	380	150	185	270	140	190	195	170
Gas Flows[2]								
Boot (Recycle), SCFH	16,900	16,200	17,100	16,900	15,100	13,900	13,700	12,800
Boot (Steam), SCFH	29,600	31,400	30,400	29,900	33,600	34,900	34,800	34,900
Steam to Side, SCFH	25,700	24,300	25,100	25,700	23,700	21,000	20,900	20,200
Air to Side, SCFH	12,200	12,000	10,000	9,900	9,800	9,800	9,700	10,000
Purges								
Recycle, SCFH	4,000	4,700	4,800	4,800	4,800	4,600	4,100	4,100
Inert, SCFH	230	230	230	230	230	230	230	230
Total Flow In, SCFH	88,600	88,800	87,600	87,400	87,200	84,400	83,400	82,200
Vent Rate, SCFH	66,400	64,000	59,600	54,500	56,100	60,100	61,600	63,100
Bed Conditions								
Boot Velocity, ft/sec	2.44	2.38	2.36	2.34	2.35	2.33	2.29	2.28
Char Bed Velocity Inlet, ft/sec	0.90	0.88	0.86	0.85	0.83	0.80	.79	.79
Boot Density, lb/ft^3[3]	90	86	89	87	84	84	84	86
Char Bed Density, lb/ft^3[3]	35	34	37	37	36	37	36	36
Boot Temperature, °F	1514	1505	1493	1503	1485	1486	1485	1484
Char Bed Temperature, °F	1511	1515	1501	1496	1482	1490	1491	1495
Overhead Gas Compositions, Mol %								
O_2	0	0	0	0	0	0	0	0
CO	15.4	16.0	15.9	14.1	15.6	14.2	14.4	15.0
CO_2	12.7	10.5	10.1	10.3	7.0	12.0	12.1	10.8
N_2	17.9	17.4	15.1	16.5	16.3	14.0	13.1	15.1
H_2	45.0	47.3	48.7	49.6	49.7	49.3	49.6	48.8
CH_4	9.0	8.8	10.2	9.5	11.5	10.5	10.8	10.3
H_2O Mol Fraction[4]	27.9	24.6	24.0	26.8	18.0	29.4	29.5	26.2

(1) Determined by feeder RPM (Rate = RPM X 484 + 267)
(2) Determined by orifice flow meter measurements
(3) Density indicated by pressure tap readings
(4) Calculated using gasifier bed temperature and assuming water-gas shift equilibrium

Table 24-1. GASIFIER DATA, RUN 24 (Sheet 3 of 3)

Date	3/7	3/7	3/8	3/8	3/8	3/9	3/9
Time	1500	2300	0700	1500	2300	0700	1500
Jacket Steam Make, lb/hr	170	140	150	200	200	330	350
Solids							
Acceptor Feedstock	← Dead-Burned Dolomite →						
Acceptor Makeup, lb/hr	300	750	600	600	900	600	600
Acceptor Circulation, lb/hr[1]	2,420	2,000	4,880	7,680	12,300	12,100	14,600
Ash & Attrited Acceptor, lb/hr[2]	0	42	42	46	65	60	72
Dolomite Activity	0	0	0	0	0	0	0
Gas Flows[3]							
Acceptor Lift, SCFH	55,700	59,200	58,600	58,700	57,700	57,900	57,800
Char Lift, SCFH	7,300	7,400	7,300	7,200	7,100	7,200	7,200
Air Line							
Recycle, SCFH	68,300	73,000	34,500	28,900	28,700	27,400	25,300
Air, SCFH	0	0	26,900	48,100	52,000	52,800	52,800
Purges							
Recycle, SCFH	1,720	1,850	1,830	1,820	1,820	1,820	1,820
Nitrogen, SCFH	1,780	1,950	1,300	1,350	1,500	1,830	1,760
Total Flow In, SCFH	134,800	143,400	130,500	146,000	148,800	148,900	146,600
Vent Rate, SCFH	13,200	15,900	36,900	58,200	64,300	69,000	66,300
Bed Conditions							
Gas Velocity Inlet, ft/sec	1.68	1.63	1.96	2.68	2.73	2.72	2.67
Bed Density, lb/ft^3[4]	109	109	103	100	96	97	98
Average Bed Temperature, °F	1123	983	1443	1858	1859	1847	1842
Overhead Gas Analyses, Mol %							
O_2	0	0	0	0	0	0	0
CO	0	2.1	6.9	3.8	3.5	1.9	1.7
CO_2	40.0	10.2	14.0	16.8	16.0	17.6	18.0
N_2	60.0	87.7	79.1	79.4	80.5	80.5	80.3

(1) Determined by lift line pressure drop measurements
(2) Determined by weigh scale measurements
(3) Determined by orifice flow meter measurements
(4) Density indicated by pressure tap readings

Table 24-2. REGENERATOR DATA, RUN 24 (Sheet 1 of 3)

Date	3/10	3/10	3/10	3/10	3/11	3/11	3/11
Time	0010	1100	1500	2300	0700	1500	2300
Jacket Steam Make, lb/hr	300	300	310	250	270	350	280
Solids							
Acceptor Feedstock	← Tymochtee Dolomite →						
Acceptor Makeup, lb/hr	600	600	600	600	600	600	600
Acceptor Circulation, lb/hr[1]	12,800	9,800	12,600	12,200	11,900	9,500	8,500
Ash & Attrited Acceptor, lb/hr[2]	106	80	102	77	85	103	95
Dolomite Activity	.05	.09	.08	.19	.18	.21	.29
Gas Flows[3]							
Acceptor Lift, SCFH	57,300	57,400	57,400	56,400	56,400	57,200	53,000
Char Lift, SCFH	7,300	7,100	7,100	7,200	7,200	7,100	7,100
Air Line							
Recycle, SCFH	12,500	15,700	0	0	0	0	0
Air, SCFH	64,100	55,200	54,300	65,000	64,400	64,000	61,800
Purges							
Recycle, SCFH	1,800	1,800	1,800	1,780	1,780	1,780	1,780
Nitrogen, SCFH	1,660	1,710	1,690	1,570	1,400	1,300	1,340
Total Flow In, SCFH	144,600	138,900	122,300	131,900	131,200	131,400	125,000
Vent Rate, SCFH	91,200	78,800	72,000	91,200	84,400	89,800	90,500
Bed Conditions							
Gas Velocity Inlet, ft/sec	2.67	2.54	2.23	2.40	2.39	2.41	2.28
Bed Density, lb/ft^3[4]	97	92	90	89	87	86	86
Average Bed Temperature, °F	1872	1851	1858	1845	1840	1860	1849
Overhead Gas Analyses, Mol %							
O_2	0	0	0	0	0	0	0
CO	2.2	1.0	2.6	2.2	1.6	3.1	3.7
CO_2	22.1	22.1	22.1	24.6	25.0	24.6	24.2
N_2	75.7	76.9	75.3	73.2	73.4	72.3	72.1

(1) Determined by lift line pressure drop measurements
(2) Determined by weigh scale measurements
(3) Determined by orifice flow meter measurements
(4) Density indicated by pressure tap readings

Table 24-2. REGENERATOR DATA, RUN 24 (Sheet 2 of 3)

Date	3/12	3/12	3/12	3/13	3/13	3/13	3/14	3/14
Time	0700	1500	2300	0700	1500	2300	0700	1500
Jacket Steam Make, lb/hr	210	200	230	250	230	230	200	210
Solids								
Acceptor Feedstock	←			Tymochtee Dolomite				→
Acceptor Makeup, lb/hr	600	600	600	600	600	600	600	600
Acceptor Circulation, lb/hr(1)	8,200	7,000	8,500	9,100	10,000	9,700	9,400	10,300
Ash & Attrited Acceptor, lb/hr(2)	100	93	131	91	92	92	97	61
Dolomite Activity	.25	.30	.27	.23	.28	.29	.28	.28
Gas Flows(3)								
Acceptor Lift, SCFH	52,200	52,200	51,700	52,200	51,300	51,600	51,100	51,500
Char Lift, SCFH	7,100	7,000	7,000	7,100	7,000	7,000	6,900	7,200
Air Line								
Recycle, SCFH	0	0	0	0	0	0	0	0
Air, SCFH	60,700	62,200	62,900	64,000	62,100	62,600	63,100	69,500
Purges								
Recycle, SCFH	1,780	1,760	1,760	1,760	1,760	1,760	1,760	1,760
Nitrogen, SCFH	1,430	1,190	1,150	1,230	1,160	1,160	1,160	1,400
Total Flow In, SCFH	123,200	124,300	124,500	126,300	123,300	124,200	124,000	131,400
Vent Rate, SCFH	83,800	85,900	87,000	88,600	81,300	89,100	90,900	105,100
Bed Conditions								
Gas Velocity Inlet, ft/sec	2.23	2.27	2.27	2.31	2.25	2.27	2.26	2.37
Bed Density, lb/ft3(4)	82	84	81	80	77	78	84	
Average Bed Temperature, °F	1837	1849	1849	1854	1842	1850	1846	1819
Overhead Gas Analyses, Mol %								
O_2	0	0	0	0	0	0	0	0
CO	3.5	0.9	3.2	3.5	2.8	2.2	2.4	2.2
CO_2	25.0	28.9	28.5	28.5	29.0	29.4	29.0	30.3
N_2	71.5	70.2	68.3	68.0	68.2	68.4	68.6	67.5

(1) Determined by lift line pressure drop measurements
(2) Determined by weigh scale measurements
(3) Determined by orifice flow meter measurements
(4) Density indicated by pressure tap readings

Table 24-2. REGENERATOR DATA, RUN 24 (Sheet 3 of 3)

Date	4/5	4/5	4/5	4/6	4/6	4/6	4/7
Time	0700	1500	2300	0700	1500	2300	0700
Jacket Steam Make, lb/hr	0	0	0	0	0	0	0
Solids							
Feedstock	Husky Char	←		Velva Lignite			→
Feed Rate, lb/hr[1]	1,480	2,200	2,100	2,300	2,570	2,450	2,800
Dump Acceptor, lb/hr	410	410	670	475	270	625	435
Char Withdrawal, lb/hr	230	190	150	220	180	160	160
Gas Flows[2]							
Boot (Recycle), SCFH	19,900	20,000	20,200	20,300	21,300	21,500	21,000
Boot (Steam), SCFH	22,500	23,200	22,700	22,700	23,200	23,100	23,600
Steam to Side, SCFH	31,900	31,100	31,100	31,400	31,100	31,100	31,200
Air to Side, SCFH	20,100	19,800	20,000	19,900	19,900	19,800	19,700
Purges							
Recycle, SCFH	3,400	3,600	3,800	3,600	3,600	3,600	3,800
Inert, SCFH	230	230	230	230	230	230	230
Total Flow In, SCFH	98,200	97,900	98,000	98,100	99,300	99,300	99,500
Vent Rate, SCFH	50,600	62,900	61,400	64,700	63,400	64,100	64,500
Bed Conditions							
Boot Velocity, ft/sec	1.82	1.96	1.96	1.96	1.93	2.04	2.09
Char Bed Velocity Inlet, ft/sec	0.92	0.95	0.94	0.94	0.94	0.96	0.97
Boot Density, lb/ft^3[3]	102	99	101	93	101	99	95
Char Bed Density, lb/ft^3[3]	46	43	34	33	34	34	32
Boot Temperature, °F	1394	1460	1435	1442	1428	1443	1482
Char Bed Temperature, °F	1441	1489	1470	1465	1464	1480	1500
Overhead Gas Compositions, Mol %							
CO	14.3	15.6	17.6	17.1	18.2	18.3	17.5
CO_2	19.6	18.1	17.6	19.0	16.6	17.9	13.3
N_2	29.6	29.6	23.5	22.6	23.5	21.7	24.5
H_2	32.3	33.0	34.6	34.3	34.5	35.0	36.0
CH_4	4.2	3.7	6.7	6.6	7.2	7.1	7.7
H_2O Mol Fraction[4]	28.66	27.65	24.97	26.63	23.02	25.14	21.81

(1) Determined by feeder RPM (Rate = RPM X 484 + 267)
(2) Determined by orifice flow meter measurements
(3) Density indicated by differential pressure measurements
(4) Calculated using gasifier bed temperature and assuming water-gas shift equilibrium

Table 24-3. GASIFIER DATA, RUN 25 (Sheet 1 of 2)

Date	4/7	4/7	4/8	4/8	4/8	4/9	4/9
Time	1500	2300	0700	1500	2300	0700	1100
Jacket Steam Make, lb/hr	0	0	5	20	15	15	10
Solids							
Feedstock	←			Velva Lignite			→
Feed Rate, lb/hr[1]	2,690	2,690	2,690	2,450	2,350	2,690	2,320
Dump Acceptor, lb/hr	480	285	0	0	615	190	210
Char Withdrawal, lb/hr	270	200	210	140	160	120	150
Gas Flows[2]							
Boot (Recycle), SCFH	21,300	19,800	19,000	22,100	22,700	15,700	15,700
Boot (Steam), SCFH	23,000	26,600	27,400	27,800	30,300	34,600	36,400
Steam to Side, SCFH	30,200	27,800	26,200	25,600	23,700	19,500	20,300
Air to Side, SCFH	20,300	19,500	18,200	15,200	8,900	8,900	6,600
Purges							
Recycle, SCFH	3,800	3,800	3,700	3,900	4,200	4,300	4,200
Inert, SCFH	230	230	230	230	230	230	230
Total Flow In, SCFH	98,800	97,700	94,700	94,800	90,000	83,200	83,400
Vent Rate, SCFH	64,900	74,400	69,300	64,600	52,400	55,500	50,200
Bed Conditions							
Boot Velocity, ft/sec	2.16	2.25	2.24	2.37	2.56	2.40	2.46
Char Bed Velocity, ft/sec	0.98	0.97	0.93	0.92	0.87	0.80	0.80
Boot Density, lb/ft^3[3]	90	86	89	90	86	80	80
Char Bed Density, lb/ft^3[3]	30	32	31	30	33	33	35
Boot Temperature, °F	1500	1499	1501	1485	1491	1473	1477
Char Bed Temperature, °F	1512	1514	1510	1492	1507	1503	1513
Overhead Gas Compositions, Mol %							
CO	17.5	16.4	16.6	17.1	16.8	17.4	16.0
CO_2	14.4	15.0	16.3	9.7	7.5	5.5	9.6
N_2	21.5	21.3	19.5	21.2	15.7	16.8	11.4
H_2	39.1	39.9	39.8	42.6	49.7	49.6	52.0
CH_4	7.5	7.4	7.7	9.4	10.4	10.7	11.0
H_2O Mol Fraction[4]	25.12	27.64	28.88	19.52	18.65	13.85	24.59

(1) Determined by feeder RPM (Rate = RPM X 484 + 267)
(2) Determined by orifice flow meter measurements
(3) Density indicated by differential pressure measurements
(4) Calculated using gasifier bed temperature and assuming water-gas shift equilibrium

Table 24-3. GASIFIER DATA, RUN 25 (Sheet 2 of 2)

Date	4/5	4/5	4/5	4/6	4/6	4/6	4/7
Time	0700	1500	2300	0700	1500	2300	0700
Jacket Steam Make, lb/hr	310	210	225	250	220	230	230
Solids							
Acceptor Feedstock	← Dead-Burned Dolomite →					Tymochtee Dolomite	
Acceptor Makeup, lb/hr	450	600	600	300	300	600	600
Acceptor Circulation, lb/hr[1]	8,000	11,300	11,500	13,200	15,300	15,600	13,300
Ash & Attrited Acceptor, lb/hr[2]	43	34	69	96	65	94	80
Acceptor Activity	0	0	0	0	0	0	0.1
Gas Flows[3]							
Acceptor Lift, SCFH	58,400	58,400	58,100	57,900	58,700	58,000	53,200
Char Lift, SCFH	7,200	7,200	7,300	7,300	7,300	7,000	7,200
Air Line							
Recycle, SCFH	19,000	30,500	29,300	18,800	0	0	0
Air, SCFH	50,300	57,700	59,900	61,900	60,600	67,500	67,900
Purges							
Recycle, SCFH	1,820	1,810	1,810	1,810	1,810	1,790	1,790
Nitrogen, SCFH	1,520	1,470	1,640	1,830	1,690	1,690	1,690
Total Flow In, SCFH	138,300	157,100	158,100	149,600	130,100	135,900	131,800
Vent Rate, SCFH	61,300	66,400	70,200	73,000	74,900	82,700	87,600
Bed Conditions							
Gas Velocity Inlet, ft/sec	2.52	2.88	2.88	2.71	2.34	2.46	2.38
Bed Density, lb/ft^3[3][4]	106	101	102	101	102	101	98
Average Bed Temperature, °F	1845	1850	1836	1836	1819	1828	1832
Overhead Gas Analyses, Mol %							
O_2	0	0	0	0	0	0	0
CO	4.88	3.94	3.25	2.15	3.06	2.15	4.14
CO_2	16.36	17.95	18.76	19.17	18.36	22.06	23.74
N_2	78.76	78.11	17.99	78.68	78.58	75.79	72.11

(1) Determined by lift line pressure drop measurements
(2) Determined by weigh scale measurements
(3) Determined by orifice flow meter measurements
(4) Density indicated by pressure tap readings

Table 24-4. REGENERATOR DATA, RUN 25 (Sheet 1 of 2)

Date	4/7	4/7	4/8	4/8	4/8	4/9	4/9
Time	1500	2300	0700	1500	2300	0700	1100
Jacket Steam Make, lb/hr	360	360	350	270	250	250	290
Solids							
Acceptor Feedstock	← Tymochtee Dolomite →						
Acceptor Makeup, lb/hr	600	600	600	600	600	600	600
Acceptor Circulation, lb/hr[1]	10,300	9,200	11,800	9,500	12,300	11,500	13,400
Ash & Attrited Acceptor, lb/hr[2]	67	80	69	84	99	110	153
Acceptor Activity	0.14	0.16	0	0.18	0.18	0.19	0.18
Gas Flows[3]							
Acceptor Lift, SCFH	53,400	53,100	53,400	52,400	53,500	52,000	52,600
Char Lift, SCFH	7,100	7,100	7,000	7,300	7,400	7,300	7,200
Air Line							
Recycle, SCFH	0	0	0	0	0	0	0
Air, SCFH	66,300	65,200	59,500	59,200	67,600	71,500	75,700
Purges							
Recycle, SCFH	1,780	1,770	1,790	1,790	1,780	1,770	1,770
Nitrogen, SCFH	1,590	1,570	1,760	1,760	1,540	1,710	1,540
Total Flow In, SCFH	130,100	128,700	123,400	122,400	131,800	134,300	138,800
Vent Rate, SCFH	89,600	86,800	80,600	67,800	89,500	95,900	98,100
Bed Conditions							
Gas Velocity Inlet, ft/sec	2.35	2.33	2.22	2.20	2.35	2.44	2.51
Bed Density, lb/ft^3[4]	89	86	62	84	83	79	76
Average Bed Temperature, °F	1823	1836	1826	1818	1800	1827	1823
Overhead Gas Analyses, Mol %							
O_2	0	0	0	0	0	0	0
CO	3.54	2.15	3.44	4.04	2.6	3.94	1.56
CO_2	25.46	26.76	24.17	24.17	25.03	26.76	28.51
N_2	71.00	71.09	72.39	71.79	72.38	69.30	69.93

(1)
(2) Determined by lift line pressure drop measurements
(3) Determined by weigh scale measurements
(4) Determined by orifice flow meter measurements
Density indicated by pressure tap readings

Table 24-4. REGENERATOR DATA, RUN 25 (Sheet 2 of 2)

Date	3/10	3/11	3/12	3/13	3/14	Run 24 Composite
	← Velva Lignite →					
		Comp.	Comp.	Comp.	Comp.	
Sample No.	6803	6870	6943	7000	7057	7079
Screen Size, Wt % Tyler Mesh						
+8						
8 X 10	1.5	1.0	0.9		0.7	
10 X 14	13.4	15.8	11.4		14.1	
14 X 20	11.1	12.6	10.0		15.4	33.2
20 X 28	12.0	12.8	12.4		15.3	
28 X 35	14.2	13.9	15.1		14.3	
35 X 48	17.5	16.5	20.2		15.4	41.2
48 X 65	13.4	12.3	15.1		10.6	
65 X 100	7.5	7.8	8.9		6.9	19.0
100 X 200	5.6	4.4	4.1		4.4	
-200	3.8	3.1	1.8		3.0	6.8
Moisture	0.53	0.71	0	0.27		1.82
Ultimate Analysis, Wt %(1)						
C	66.43	65.81	68.66	66.55	66.69	67.49
H	3.40	4.15	4.54	4.07	4.70	4.45
S	0.50	0.50	0.37	0.42	0.46	0.52
Ash + SO_3	7.89	7.76	6.96	9.34	6.82	7.63
Elemental Analysis, Wt %(2)						
SiO_2	27.2	27.33	22.89	32.94	25.99	24.99
SO_3	10.98	10.39	11.03	9.99	9.82	9.21
Na_2O	1.01	1.24	1.30	0.84	1.06	1.30
CaO						38.54
MgO						9.80
K_2O						0.04
P_2O_5						0.26
Al_2O_3						11.61
Fe_2O_3						4.83
TiO_2						0.19

Screen Size, Wt % Tyler Mesh	Run 24 Tymochtee Dolomite Composite
+6	58.8
6 X 12	35.0
12 X 20	6.0
20 X 28	0.1
-28	0.1
	0.07(3)
	4.92
	0.50
	0.08
	54.61
	37.35
	0.02
	0.06
	1.47
	0.69
	0.01

(1) Dry basis
(2) As received
(3) As sulfide

Table 24-5. FEEDSTOCK COMPOSITES, RUN 24

	Velva Lignite Daily Composites				Run 25		
Date	4/6	4/7	4/8	4/9	Velva Lignite Composite		Tymochtee Dolomite Composite
Sample No.	7224	7279	7343	7402			
Screen Size, Wt % Tyler Mesh						Screen Size, Wt % Tyler Mesh	
+20	25.7	39.9	37.0	39.3	35.5	+9	73
20 X 48	45.5	42.4	41.3	41.3	42.6	9 X 12	25
48 X 100	18.4	12.9	15.5	12.4	14.8	12 X 20	2.0
-100	10.4	4.7	8.2	7.0	7.1	20 X 28	Tr
						-28	Tr
% Calcine Weight Change							-31.04
Moisture	2.16	1.15	1.32	0 98	0.78		
Ultimate Analysis, Wt %[1]							
C	66.93	65.74	65.92	66.45	65.54		
H	4.19	3.68	3.35	4.57	4.57		
N					0.95		
S	0.72	0.54	0.50	0.43	1.65		0.01[3]
Ash + SO_3	9.92	7.83	7.39	7.82	8.57		
Elemental Analysis, Wt %[2]							
SiO_2	28.20	29.60	25.73	29.56	26.07		3.18
SO_3	16.97	11.60	13.50	10.30	13.73		0.27
Na_2O	1.19	0.78	0.88	0.96	1.28		0.05
CaO					32.34		55.13
MgO					8.92		36.78
K_2O					0.05		0.01
P_2O_5					0.14		0.01
Al_2O_3					11.55		1.50
Fe_2O_3					4.50		1.25
TiO_2					0.40		0.02

(1) Dry basis
(2) As received
(3) As sulfide

Table 24-6. FEEDSTOCK COMPOSITES, RUN 25

Date	3/9	3/10	3/10	3/11	3/11	3/12	3/12	3/13	3/13	3/14	3/14
Time	2000	0800	2000	0830	1915	0810	2200	0800	2200	0800	1545
Sample No.	6729	6761	6796	6832	6859	6900	6941	6965	7007	7030	7053
Screen Size, Wt %											
Tyler Mesh											
+6	0.0	Tr				0.0	0.0				0.0
6 X 8	0.7	1.3	1.4	0.7	5.7	3.2	6.7	9.3	6.8	7.8	7.0
8 X 9	0.3	3.2	3.5	3.1	11.3	8.1	15.9	17.2	15.2	18.4	16.5
9 X 10	19.7	14.2	18.3	15.3	23.8	20.3	25.6	23.1	24.1	23.5	22.6
10 X 12	39.1	28.5	30.2	25.6	25.2	21.3	21.8	18.8	19.1	18.5	17.4
12 X 14	24.4	26.6	27.5	22.9	18.1	18.5	15.7	13.1	13.9	13.7	13.6
14 X 16	10.5	14.3	12.8	13.7	8.1	8.5	6.4	5.7	5.9	6.8	7.0
16 X 20	3.5	6.1	3.9	5.4	2.5	3.8	1.8	3.4	4.7	4.1	4.9
20 X 24	0.6	1.7	0.9	2.4	1.2	2.3	1.4	2.1	2.3	2.3	2.8
24 X 28	0.3	1.3	0.5	2.7	0.7	2.6	1.1	1.9	1.9	1.0	2.2
-28	1.1	2.8	1.1	8.3	3.3	11.4	3.5	5.4	6.1	1.0	6.0
% Calcine Weight Change		0		-0.4		-0.2		-2.5		-2.4	
Elemental Analysis, Wt %											
S=		0.04		0.06		0.06		0.06		0.05	
SiO_2		4.62		9.71		10.60		10.37		8.08	
SO_3		0.10		0.26		0.21		0.27		0.15	

Table 24-7. CALCINED ACCEPTOR RETURN, RUN 24

Date	3/9	3/10	3/10	3/11	3/11	3/12	3/12	3/13	3/13	3/14	3/14
Time	2000	0400	1545	0000	1200	0800	2000	0400	1540	0430	1330
Sample No.	6727	6752	6783	6807	6838	6898	6931	6957	6984	7020	7048
Screen Size, Wt %											
Tyler Mesh											
+6	0	0	0	0	Tr	0	0	Tr	0	0	0
6 X 8	Tr	1.6	1.7	1.3	2.8	5.2	6.4	4.5	7.5	7.7	6.9
8 X 9	Tr	2.6	3.5	4.5	8.2	12.6	14.7	12.7	17.5	17.1	15.7
9 X 10	13.2	13.8	19.4	19.7	21.0	24.8	25.0	24.9	24.9	24.1	25.0
10 X 12	31.5	31.7	30.4	29.8	26.8	23.8	21.5	21.8	20.1	18.3	18.9
12 X 14	30.0	28.7	26.2	24.9	22.2	18.4	16.6	17.6	14.2	13.3	14.0
14 X 16	17.1	14.4	13.7	12.7	11.1	7.9	6.7	7.7	6.1	6.3	6.6
16 X 20	6.7	5.5	4.0	4.2	3.8	3.1	3.4	4.0	3.7	4.6	4.7
20 X 24	1.0	0.9	0.8	1.1	1.4	1.4	1.8	2.3	2.2	2.9	2.8
24 X 28	0.4	0.3	0.3	0.6	1.2	1.2	1.5	1.8	1.5	2.6	2.5
-28	0.2	0.5	0.1	1.2	1.5	1.5	2.5	2.7	2.1	3.1	3.0
Particle Density, lb/ft^3		183.4	180.0	181.5	181.4	156	156.8	167	157.3	162.0	163.6
Activity	0.05	0.07	0.08	0.19	0.20	0.25		0.23	0.28	0.29	0.29
% Calcine Weight Change	-3.6		-4.0	-5.7	-6.8	-8.9	-9.1	-10.0	-9.9	-10.6	-10.0
Elemental Analysis, Wt %											
SiO_2	2.73		4.49	4.39	6.27	6.52	7.61	7.31	8.40	9.30	10.54
SO_3	0.06		0.15	0.13	0.17	0.25	0.03	0.33	0.19	0.25	0.25

Table 24-8. RECARBONATED ACCEPTOR RETURN, RUN 24

Date	4/5	4/6	4/7	4/8	4/9
Time	0410	0800	0810	0800	0800
Sample No.	7127	7188	7247	7314	7382
Screen Size, Wt %					
Tyler Mesh					
+9	0.7	0.9	3.9	13 9	28.8
9 X 12	34.4	48.2	41.8	42.0	39.6
12 X 20	63.1	49.6	50.4	36.3	20.5
20 X 28	1.0	0.9	2.1	4.0	6.0
-28	0.1	0.4	1.8	3.8	5.1
% Calcine Weight Change	-1.5	-0.1	0	-0.7	-0.5
Elemental Analysis, Wt %					
S=	0.03	0.03	0.02	0.03	0.04
SiO_2	0.45	2.06	5.50	6.49	8.72
SO_3	0.20	0.25	0.25	0.50	0.55
Na_2O	0.01	0.02	0.07	0.05	0.09
CaO	58.89	58.11	56.28	56.22	55.20
MgO	39.46	37.04	34.63	33.51	32.23
K_2O	Tr	Tr	0.01	0.01	0.01
P_2O_5	0.01	0.01	0.02	0.02	0.04
Al_2O_3	0.50	0.75	1.49	1.75	2.24
Fe_2O_3	1.80	1.80	1.64	1.40	1.30
TiO_2	0.05	0.09	0.07	0.07	0.09

Table 24-9. CALCINED ACCEPTOR RETURN, RUN 25

Date	4/5	4/6	4/7	4/8	4/9
Time	0445	0800	0830	0400	0800
Sample No.	7123	7182	7243	7305	7379
Screen Size, Wt %					
Tyler Mesh					
+9	0.6	0.4	6.1	12.4	16.5
9 X 12	31.5	39.3	41.4	47.0	44.5
12 X 20	64.4	58.7	50.8	37.2	30.1
20 X 28	2.5	1.4	1.7	1.8	4.0
-28	1.0	0.1	0	1.7	4.9
Particle Density, lb/ft^3 (1)	204	205	193.8	185.2	
Activity	0.02	0.01	0.10	0.14	0.19
% Calcine Weight Change	-1.4	-1.2	-4.9	-6.1	-6.1
Elemental Analysis, Wt %					
S=		0.01	0.01		0.04
SiO_2	2.45	2.16	4.54	7.05	8.09
SO_3	0.15	0.20	0.20	0.22	0.32
Na_2O	0.02	0.03	0.04	0.03	0.04
CaO	56.81	59.51	55.42	55.76	55.24
MgO	37.61	35.78	35.25	33.65	32.32
K_2O	Tr	Tr	Tr	Tr	0.01
P_2O_5	Tr	Tr	0.01	0.01	0.02
Al_2O_3	1.50	1.75	1.94	1.94	2.25
Fe_2O_3	0.75	1.25	0.92	0.68	0.65
TiO_2	0.02	0.05	0.07	0.10	0.07

(1) 12 mesh particle, Tyler screen

Table 24-10. RECARBONATED ACCEPTOR RETURN, RUN 25

Date	3/9		3/10		3/10		3/11		3/11	
Time	1200		0000		1200		0420		1200	
Sample No.	6703		6739		6770		6814		6843	
Screen Size, Wt % Tyler Mesh	As Received	Acceptor Fraction	As Received	Acceptor Fraction	As Received	Acceptor Fraction	As Received	Acceptor Fraction	As Received	Acceptor Fraction
+8	Tr	↓	0.2	↓	0.3	↓	1.3	↓	1.5	↓
8 X 10	0.5		3.5		4.1		9.7		8.8	
10 X 14	22.6	48.7	29.3	52.4	29.9	50.6	27.2	50.4	26.2	52.0
14 X 20	13.6	37.0	13.3	39.3	12.1	33.0	12.1	26.7	10.8	24.1
20 X 28	9.8	2.4	6.7	3.1	7.0	4.3	8.1	4.8	8.5	6.8
28 X 35	13.3	3.2	10.4	2.4	10.1	4.5	10.7	5.8	11.3	7.6
35 X 48	15.3	3.9	13.5	1.9	13.3	4.7	12.6	6.0	13.3	6.3
48 X 65	9.9	2.5	9.6	0.7	9.0	2.1	7.7	4.3	8.2	2.6
65 X 100	8.5	1.0	8.1	0.2	7.6	0.6	6.0	2.0	6.8	0.7
100 X 200	4.9	0	4.5	0	4.9	0	3.6	0	3.6	0
-200	1.7	0.5	0.9	0	1.7	Tr	1.0	Tr	1.0	Tr
% Char	57.5		46.9		46.6		39.5		45.4	
Ash + SO_3	17.46		17.87		17.18		8.15		14.13	
Ash Elemental Analysis, Wt %										
SiO_2	22.94		22.79		28.66		27.23		26.4	
SO_3	1.50		1.58		2.46		3.76		3.88	
Na_2O	1.90		1.41		1.78		1.18		1.38	

(1) Samples taken from gasifier bed

Table 24-11. REGENERATOR FUEL CHAR(1), RUN 24 (Sheet 1 of 2)

Date	3/12		3/12		3/13		3/13		3/14		3/14	
Time	0000		1200		0030		1230		0000		0430	
Sample No.	6873		6911		6944		6978		7013		7019	
Screen Size, Wt Tyler Mesh	As Received	Acceptor Fraction	As Received	Acceptor Fraction	As Received	Acceptor Fraction	As Received	Acceptor Fraction	As Received	Acceptor Fraction	As Received	Acceptor Fraction
+8	1.2	↓	2.0	↓	3.3	↓	1.7	↓	1.9	↓	2.5	↓
8 X 10	8.1		10.5		14.2		10.3		9.9		11.5	
10 X 14	20.5	48.3	23.2	50.1	21.1	54.2	18.0	47.4	17.9	47.1	15.6	51.3
14 X 20	9.6	24.7	10.1	23.6	8.6	21.6	8.3	19.7	9.5	20.2	8.7	18.6
20 X 28	9.4	7.9	10.1	8.1	8.6	8.0	10.0	9.1	10.9	10.2	10.4	9.4
28 X 35	12.7	8.4	12.2	8.4	10.8	7.5	13.2	10.4	13.1	11.4	13.3	9.4
35 X 48	15.6	7.3	13.9	6.9	13.1	6.0	15.9	9.1	14.8	7.4	15.4	7.5
48 X 65	9.4	2.8	7.6	2.5	8.0	2.3	9.3	3.7	8.6	2.9	8.9	3.1
65 X 100	7.5	0.6	5.8	0.4	6.8	0.4	7.7	0	7.4	0.8	7.5	0.7
100 X 200	4.4	0	3.1	0	4.1	0	4.5	0	4.5	0	4.8	0
-200	1.7	0	1.2	Tr	1.5	0	1.1	Tr	1.6	0	1.5	Tr
% Char	46.0		49.4		43.9		51.0		55.4		47.9	
Ash + SO_3	14.62		14.50		13.73		17.40		15.11		15.04	
Ash Elemental Analysis, Wt %												
SiO_2	21.19		20.08		16.75		23.69		20.50		23.47	
SO_3	4.04		3.27		2.98		3.23		2.77		2.55	
Na_2O	1.22		1.13		0.92		1.29		0.90		1.04	

(1) Samples taken from gasifier bed

Table 24-11. REGENERATOR FUEL CHAR(1), RUN 24 (Sheet 2 of 2)

Date	4/5		4/6		4/7		4/8		4/9	
Time	0500		0400		0520		0620		0325	
Sample No.	7125(1)		7176(2)		7240(2)		7308(2)		7366(2)	
	As Received	Acceptor Fraction	As Received	Acceptor Fraction	As Received	Acceptor Fraction	As Received	Acceptor Fraction	As Received	Acceptor Fraction
Screen Size, Wt % Tyler Mesh										
+8	0.1				0.3		1.6		2.2	
8 X 10	0.9		1.6		2.4		9.7		11.1	
10 X 14	28.9	36.5	30.3	42.0	24.3	34.8	35.7	54.1	24.7	60.0
14 X 20	23.5	56.2	19.0	46.5	16.4	44.6	15.1	29.4	21.9	22.0
20 X 28	11.6	3.1	12.5	3.4	12.7	4.7	11.1	5.2	19.4	8.4
28 X 35	10.5	1.1	14.6	2.0	17.0	5.9	10.9	4.8	12.5	4.4
35 X 48	9.5	1.1	12.8	2.3	15.6	5.4	9.1	3.3	6.1	2.0
48 X 65	5.6	1.3	5.8	2.5	7.0	3.5	4.0	2.5	1.6	1.6
65 X 100	4.5	0.7	2.8	1.4	3.6	1.2	2.3	0.7	0.6	1.6
100 X 200	3.3	0	0.7	0	0.9	0	0.6	0	0	0
-200	1.5	0	Tr	0	0	0	Tr	0	Tr	0
% Char	54.1		56.9		40.4		40.2		54.6	
Ash + SO_3	15.2		14.35		18.54		10.96		10.42	
Ash Elemental Analysis, Wt %										
SiO_2	23.31	2.83	20.99	9.46	17.95	16.43	19.84	16.65	17.83	19.32
SO_3	10.54	0.18	7.03	0.38	1.50	0.05	4.04	0.46	4.56	0.32
Na_2O	1.47	0.06	1.10	0.15	0.94	0.20	1.01	0.13	0.60	0.15
CaO	33.85	56.10	39.22	53.83	48.94	48.70	44.67	48.06	45.47	46.70
MgO	10.91	40.00	11.49	33.22	12.89	33.04	11.81	30.67	12.21	29.61
K_2O	0.04	Tr	0.04	0.01	0.04	0.01	0.02	0.02	0.04	0.13
P_2O_5	0.04	Tr	0.18	0.01	0.25	0.03	0.27	0.04	0.29	0.06
Al_2O_3	13.64	1.25	13.44	1.67	11.24	2.47	11.89	3.41	12.39	3.21
Fe_2O_3	4.65	1.13	5.57	1.81	5.62	1.32	5.32	1.30	5.56	1.15
TiO_2	0.62	0.08	0.61	0.09	0.62	0.10	0.62	0.10	0.38	0.05

(1) Sample taken from S-13B sample point
(2) Sample taken from regenerator fuel char standleg

Table 24-12. REGENERATOR FUEL CHAR, RUN 25

	Daily Composites					
Date	3/9	3/10	3/11	3/12	3/13	3/14
Sample No.	6734	6800	6862	6948	7001	7059
Screen Size, Wt %						
Tyler Mesh						
+60	Tr	2.5	10.2	0.5	0.5	Tr
60 X 100	15.5	10.1	32.8	6.8	1.1	3.2
100 X 325	43.1	30.0	41.3	39.4	44.8	34.9
-325	41.4	57.4	15.7	53.4	53.7	61.9
Ultimate Analysis, Wt %						
(Dry Basis)						
C	57.85	60.68	55.04	62.73	59.56	56.68
H	1.83	2.06	0.92	1.05	1.15	1.63
S (Total)		0.63	0.58	0.50	0.66	0.55
Ash + SO_3	32.16	27.79	29.21	28.14	31.02	25.38
Elemental Analysis, Wt %						
SiO_2	25.64	28.55	27.66	23.83	26.80	31.00
SO_3	3.13	6.45	6.43	6.88	7.21	5.87
Na_2O	1.23	0.85	1.14	0.93	0.79	0.54

Table 24-13. GASIFIER CHAR TO ORGANIC POND, RUN 24

	Daily Composites			
Date	4/6	4/7	4/8	4/9
Sample No.	7218	7278	7344	7411
Screen Size, Wt %				
Tyler Mesh				
+60	5.1	Tr	Tr	0.2
60 X 100	12.4	4.9	2.2	2.2
100 X 325	41.1	43.0	45.0	28.7
-325	41.5	52.0	52.8	68.8
Ultimate Analysis, Wt %				
(Dry Basis)				
C	62.71	64.60	64.79	61.60
H	1.08	2.39	3.41	0.81
S (Total)	0.40	0.66	0.53	0.71
Ash + SO_3	28.60	27.44	26.74	29.80
Elemental Analysis, Wt %				
SiO_2	31.60	25.58	28.66	30.80
SO_3	8.82	8.00	7.40	6.96
Na_2O	1.13	0.88	1.00	0.98

Table 24-14. GASIFIER CHAR TO ORGANIC POND, RUN 25

Date	3/9	3/10	3/10	3/11	3/11	3/12	3/12	3/13	3/13	3/13	3/14
Time	1655	0015	1245	0050	1130	0010	1215	0030	1830	2330	0450
Sample No.	6720	6746	6774	6811	6840	6879	6915	6946	6994	7010	7025
Screen Size, Wt %											
Tyler Mesh											
+35	0.8	0.6		1.7	1.1	3.4	2.3	1.0	0.6	0.7	Tr
35 X 48	6.6	4.0	4.5	4.2	4.3	5.0	3.4	3.5	3.2	2.9	0.8
48 X 65	10.7	7.7	9.2	8.5	8.8	9.3	7.8	7.2	7.2	8.7	3.3
65 X 100	13.0	10.8	13.3	12.5	12.7	12.3	10.8	10.1	11.8	12.5	7.1
100 X 200	17.1	19.5	19.1	21.4	20.8	18.7	20.0	21.7	21.2	21.0	22.1
200 X 325	12.3	20.3	13.9	26.5	23.9	25.5	24.9	36.2	24.6	25.3	31.4
-325	39.6	36.9	40.0	25.1	28.4	25.9	31.0	20.4	31.4	29.0	35.2
% Calcine Weight Change	-6.5	-3.3	-3.9	-1.9	-1.6	-1.0	-1.0	-0.3	-0.6	-0.7	-0.5
Elemental Analysis, Wt %											
SiO_2	41.66	35.13	39.56	30.77	31.66	28.82	27.34	23.59	27.68	30.09	27.65
SO_3	0.67	1.54	1.72	2.29	2.64	3.12	4.46	3.86	3.12	3.68	3.81
Na_2O	2.02	1.06	1.44	1.18	0.95	1.04	1.20	1.14	1.09	1.07	1.05

Table 24-15. ASH AND ATTRITED ACCEPTOR, RUN 24

Date	4/5	4/5	4/6	4/6	4/7	4/7	4/8	4/8	4/9	4/9
Time	0915	1810	0440	1235	0845	1800	0810	1730	0600	2045
Sample No.	7134	7154	7179	7202	7249	7277	7315	7340	7374	7407
Screen Size, Wt %										
Tyler Mesh										
+35	0.5	0.2	1.3	1.0	1.1	0.6	0.5	2.7	1.3	1.1
35 X 48	3.6	3.4	6.2	5.7	4.2	3.3	3.5	10.7	3.8	4.9
48 X 65	7.4	8.3	10.7	9.4	8.6	7.9	7.8	15.4	8.2	9.0
65 X 100	13.4	13.4	13.8	11.7	13.9	11.9	13.1	15.2	12.5	12.7
100 X 200	25.3	23.8	20.5	20.4	22.5	30.4	23.5	19.5	21.2	21.8
200 X 325	14.3	14.7	12.9	14.4	17.9	32.4	15.3	10.7	14.6	15.9
-325	35.5	36.2	34.6	37.4	32.0	13.6	36.5	25.8	38.4	34.5
Calcined Weight Change	-3.3	-2.9		-2.6	-2.6	-2.7	-1.0	-2.5	-5.6	-3.6
Elemental Analysis, Wt %										
SiO_2	32.66	34.65	40.41	40.04	26.47	24.57	30.02	39.57	28.89	29.82
SO_3	5.88	5.00	0.85	0.39	3.74	4.37	5.95	4.40	4.39	4.03
Na_2O	1.55	1.81	1.57	1.28	1.40	1.39	1.41	1.05	1.18	0.96
CaO	31.63	31.30	31.60	33.66	39.58	39.65	36.09	32.42	37.12	37.62
MgO	11.40	10.61	9.95	9.95	15.03	16.67	12.62	11.38	15.93	15.96
K_2O	0.02	0.03	0.04	0.03	0.08	0.08	0.05	0.03	0.06	0.04
P_2O_5	0.04	0.04	0.12	0.15	0.13	0.11	0.14	0.14	0.13	0.13
Al_2O_3	10.84	11.37	11.14	10.62	9.36	9.37	8.40	7.66	7.75	7.09
Fe_2O_3	5.11	5.65	4.79	5.00	3.49	3.00	3.62	3.45	3.42	3.18
TiO_2	0.45	0.45	0.45	0.47	0.50	0.25	0.23	0.19	0.16	0.20
S=	1.57	1.08	0.02	0.05	0.73	1.18	1.50	0.90	0.92	1.05

Table 24-16. ASH AND ATTRITED ACCEPTOR, RUN 25

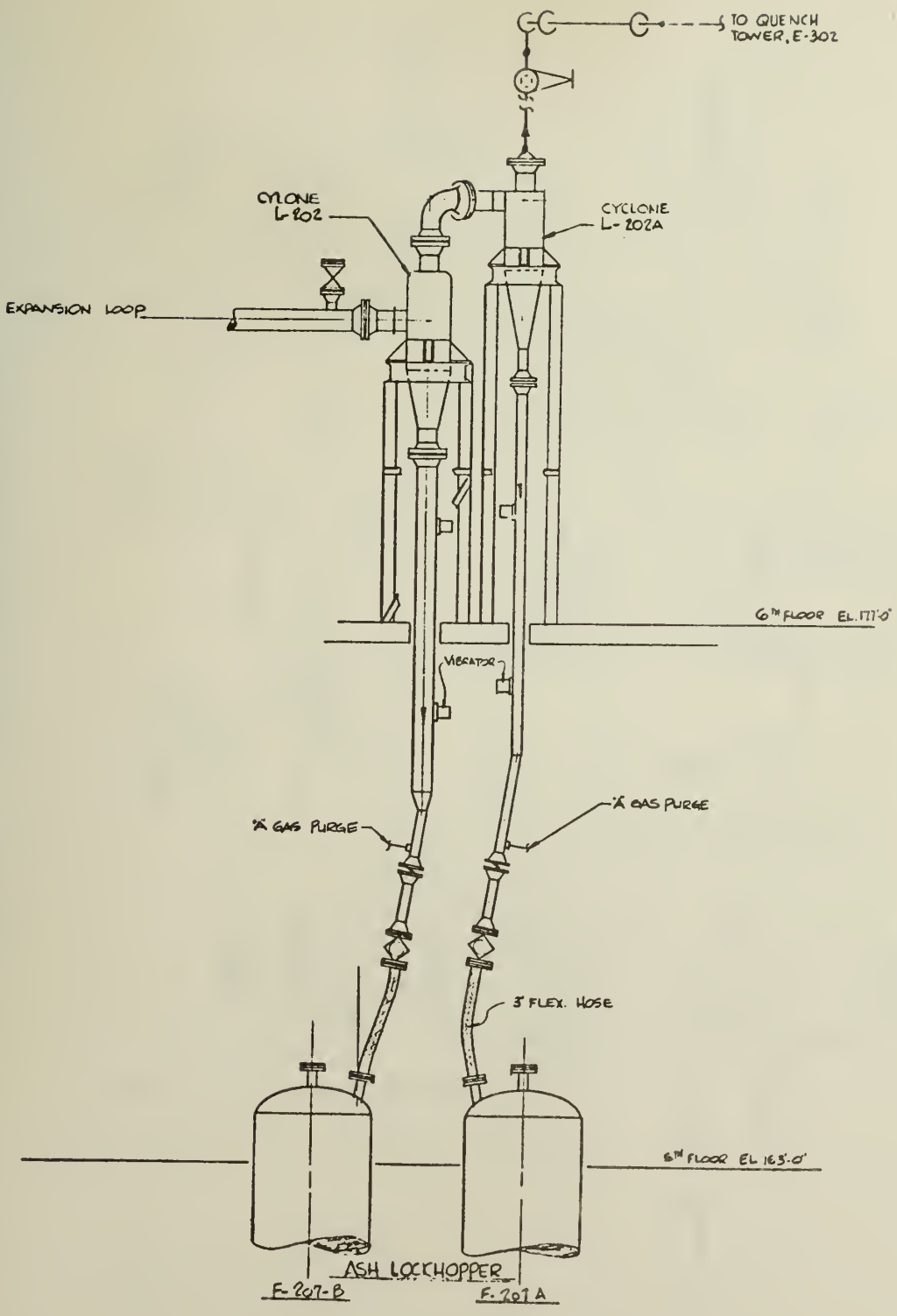

Figure 22-8. MODIFIED REGENERATOR CYCLONE INSTALLATION

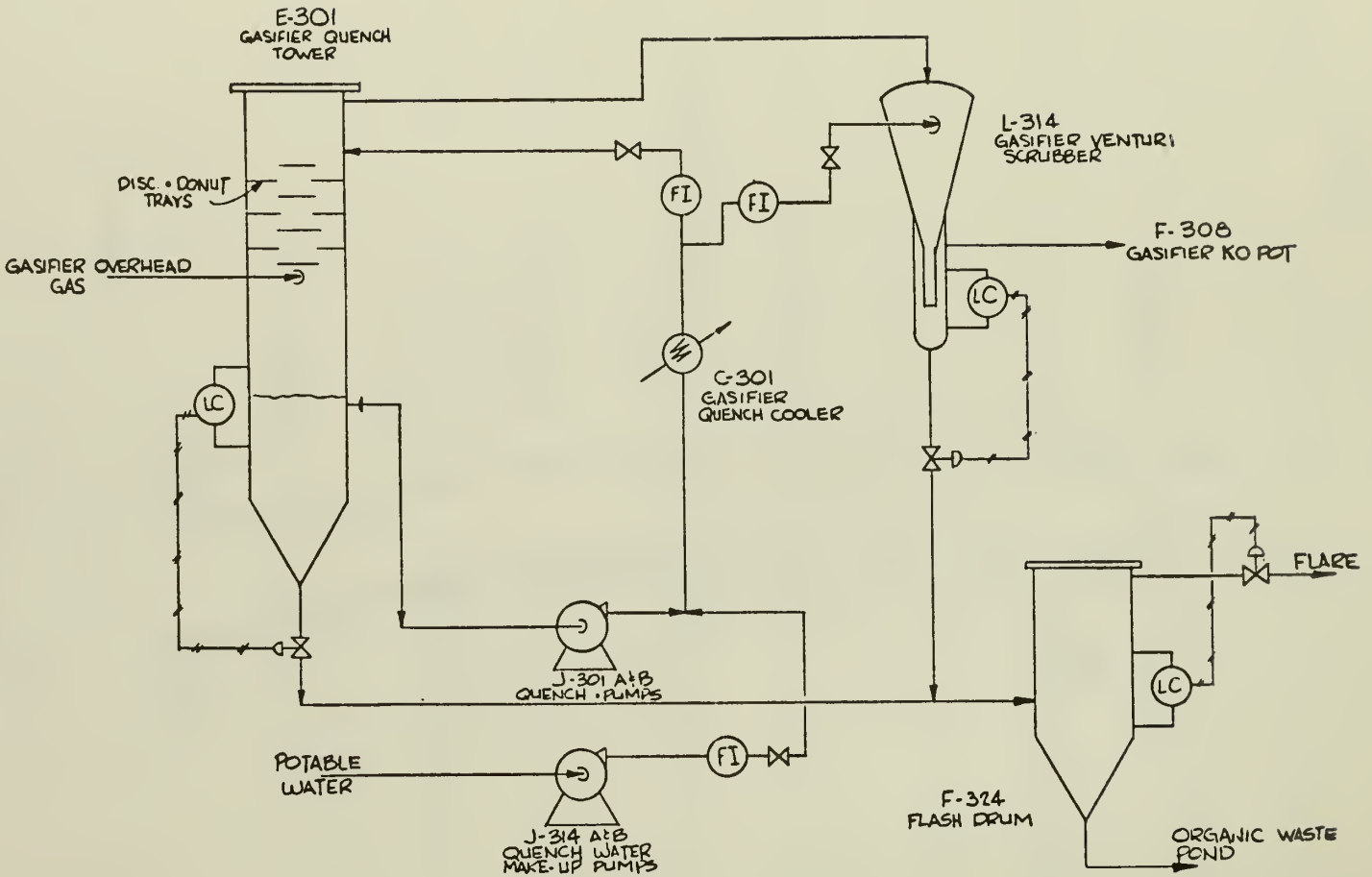

Figure 22-9. REVISED GASIFIER QUENCH SYSTEM

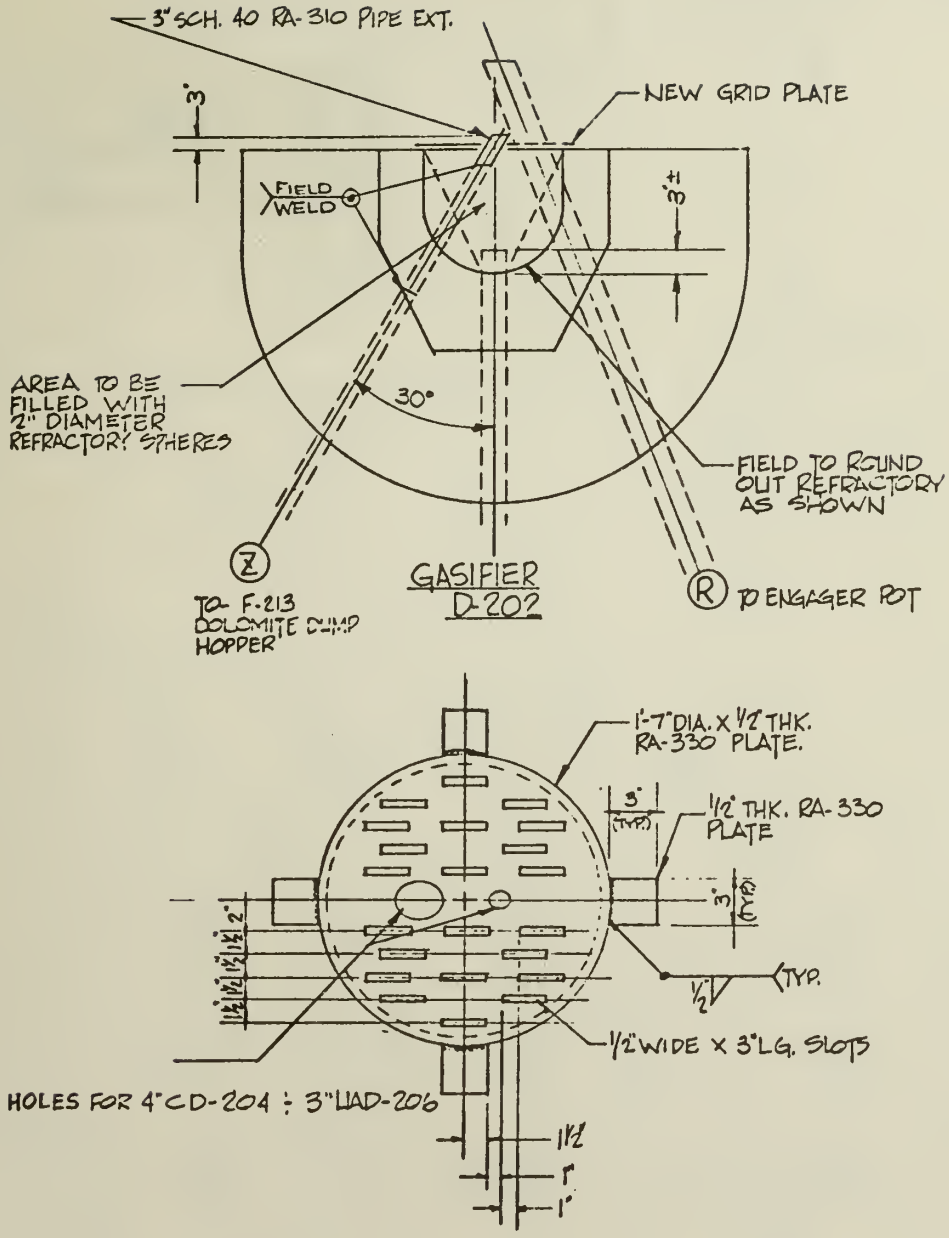

Figure 22-10. GRID PLATE GAS DISTRIBUTOR

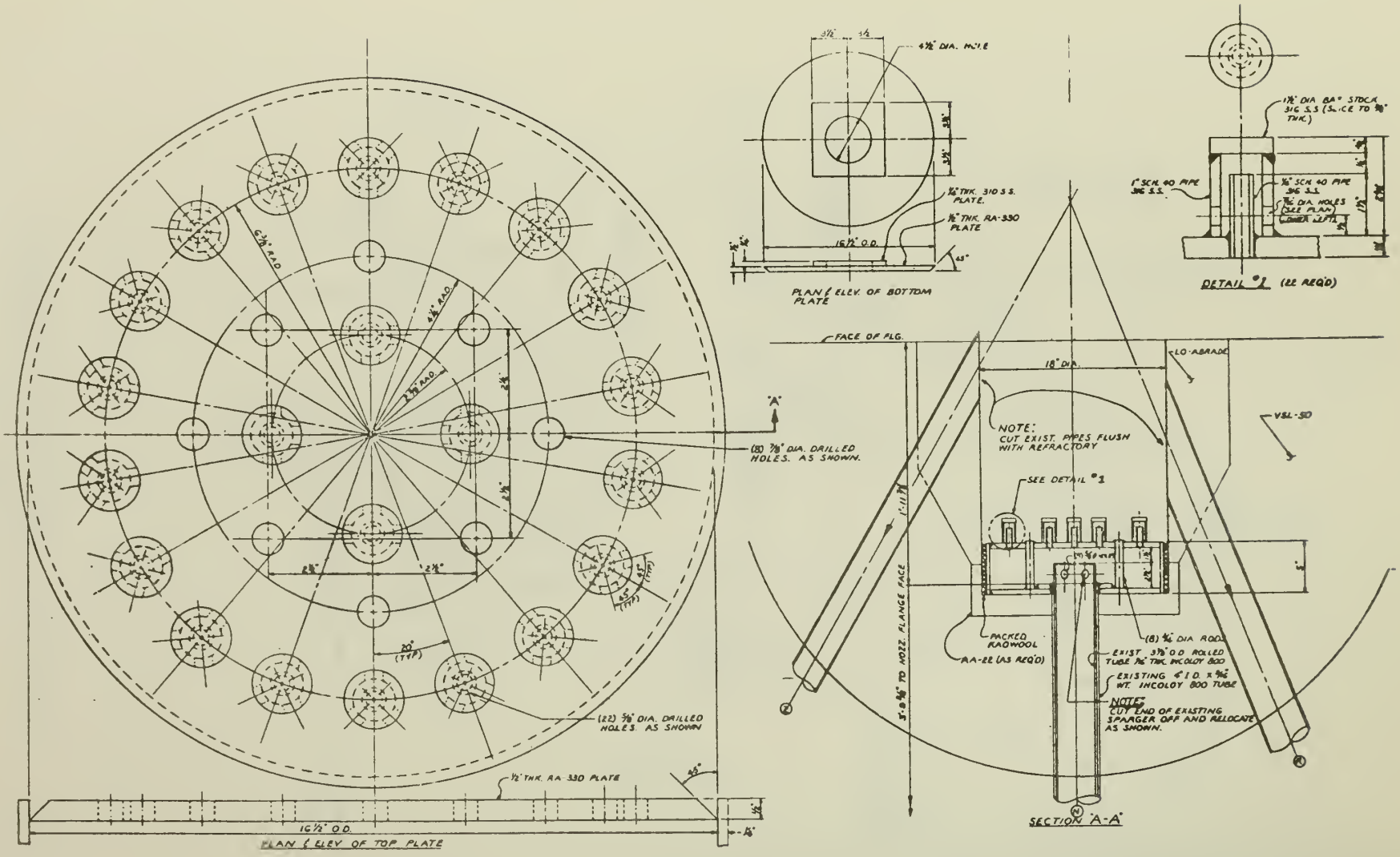
4½" DIA. HOLE
½" THK. 310 S.S. PLATE.
½" THK. RA-330 PLATE
16½" O.D.
PLAN & ELEV. OF BOTTOM PLATE
1⅞" DIA. BAR STOCK 316 S.S (SLICE TO ¾" THK.)
1" SCH. 40 PIPE 316 S.S.
½" SCH. 40 PIPE 316 S.S.
¾" DIA. HOLES (SEE PLAN) EQUALLY SPACED
DETAIL "1" (22 REQ'D)
FACE OF FLG.
18" DIA.
LO-ABRADE
VSL-50
NOTE: CUT EXIST. PIPES FLUSH WITH REFRACTORY
SEE DETAIL "1"
PACKED RADWOOL
AA-22 (AS REQ'D)
(8) ¾ DIA ROD
EXIST. 3⅞" O.D. ROLLED TUBE ⅜" THK. INCOLOY 800
EXISTING 4" I.D. x ⅜" WT. INCOLOY 800 TUBE
NOTE: CUT END OF EXISTING SPARGER OFF AND RELOCATE AS SHOWN.
SECTION "A-A"
"A"
(18) ⅞" DIA. DRILLED HOLES. AS SHOWN.
(22) ⅝" DIA. DRILLED HOLES. AS SHOWN
½" THK. AA-330 PLATE
16½" O.D.
PLAN & ELEV. OF TOP PLATE

Figure 22-11. GASIFIER BOOT GAS DISTRIBUTOR

Run	Lift Gas Flow, SCFH	Lift Gas Temperature, °F	Lift Gas Pressure, PSIA	Upper Lift Line Pressure Drop, In. W.C. Measured	Fanning
22A	40,000	1250	173	2.38	1.89
	49,690	1250	173	3.50	2.78
	58,180	1250	173	4.38	3.68
	77,570	1250	173	7.50	6.17
	101,810	1250	173	11.5	10.1
22B	39,040	1170	173	2.50	1.71
	48,800	1170	173	3.50	2.55
	58,560	1170	173	4.75	3.53
	78,080	1170	173	6.50	5.91
	98,820	1170	173	9.75	9.04
22C	50,760	1150	168	3.50	2.77
	61,160	1150	168	4.63	3.87
	70,840	1150	168	5.75	5.04
	81,210	1150	168	7.63	6.45
	94,430	1150	168	9.75	8.46
23	48,640	1170	171	3.50	2.56
	59,580	1170	171	4.25	3.68
	78,800	1170	171	6.38	6.08
	85,120	1170	171	7.38	6.99

Table 22-1. ACCEPTOR LIFT LINE GAS, FLOW TEST DATA, RUN 22 AND 23

Solids Circulation Rate, lb/hr	Lift Gas Velocity, ft/sec	Lift Gas Temperature, °F	Lift Gas Pressure, PSIA	Upper Lift Line Pressure Drop, In. W.C. Measured	Corrected	Fanning
Run 22A						
Date - 9/24/74						
Lift Gas - Air						
6,340	55.5	1150	173	9.25	8.45	4.34
17,030	56.0	1150	173	20.0	19.20	4.42
Run 22B						
Date - 11/26/74						
Lift Gas - Air						
2,690	45.5	1180	173	5.0	4.20	3.00
7,060	45.5	1180	173	10.0	9.20	3.00
15,620	44.9	1180	173	20.8	20.00	2.94
Run 22C						
Date - 12/16/74						
Lift Gas - Air						
4,780	51.5	1150	171	7.50	6.70	3.76
4,780	40.8	↓	↓	8.25	7.45	2.48
4,780	60.5			8.13	7.33	5.03
4,780	51.5			7.63	6.83	3.76
9,610	51.5			11.50	10.70	3.76
9,610	40.3			15.00	14.20	2.42
9,610	61.1			11.00	10.20	5.12
9,610	51.5			11.85	11.08	3.76
12,870	51.5			15.25	14.45	3.76
12,870	40.8			19.25	18.45	2.48
12,870	61.2			13.38	12.58	5.12
12,870	52.0			15.63	14.83	3.83
Run 23						
Date - 1/16/75						
Lift Gas - Air						
4,740	50.7	1170	171	7.25	6.45	3.64
10,370	50.7	1170	171	12.75	11.95	3.64
12,310	50.7	1170	171	16.25	15.45	3.64
5,390	51.2	1150	168	7.5	6.70	3.68
8,040	51.2	1150	168	10.5	9.70	3.68
11,180	51.2	1150	168	13.75	12.95	3.68

Table 22-2. DEAD-BURNED DOLOMITE CIRCULATION DATA, RUNS 22 AND 23

Input

Intermediate Fines in Feedstocks

Husky Char, 20,100 lbs (1.65% Junk), lbs	332
Velva Lignite, 30,700 lbs (1.05% Junk), lbs	322
Total New Junk Material	654

Output

Char Removal Hoppers

← Time →			Solids Removed						
			Total	← Weight, % →			← Lbs →		
On	Off	Hrs.	Lbs	Char	Acceptor	Junk	Char	Acceptor	Junk
1410	1935	5.42	1,175	30.6	46.8	22.6	360	550	266
1935	0145	6.17	1,085	40.0	34.5	19.5	499	374	212
0145	0745	6.00	1,185	37.8	38.9	23.3	448	461	276
0745	1315	5.50	860	48.5	27.7	23.8	417	238	205
1315	1810	4.92	770	47.5	25.6	26.9	366	197	207
1810	(2025)	2.25	265	51.0	19.3	29.7	135	51	79
								Total	1,245

Purged Acceptor Hopper

1410	0130	4240	-	94.0	6.0	-	3,986	254
0130	2025	6630	-	96.3	3.7	-	6,385	245
							Total	499

Net Junk Removal (Output-Input), lbs 1,090 lbs

Table 22-3. INTERMEDIATE FINES REMOVAL DURING "DEJUNKING PERIOD" (1410 HRS 1/24/75 TO 2025 HRS 1/25/75), RUN 23

Date 9/19/74

Rail Car No.	6305		60341		6511	
	+1/4	-14M	+1/4	-14M	+1/4	-14M
Screen Size, Wt %						
Tyler Mesh						
+1/4		80.0		78.9		82.9
-1/4		20.0		21.1		17.1
8		53.8		42.0		33.8
10		12.2		12.9		12.7
14		9.0		10.9		11.2
Pan		24.9		34.2		42.3
Ultimate Analysis, Wt %(1)						
HOH (As Received)	(39.51)	(38.79)	(38.47)	(35.20)	(39.64)	(39.82)
C	65.37	60.18	63.81	61.72	64.79	60.16
H	4.08	3.95	4.78	3.96	4.52	3.93
S	0.45	0.68	0.48	0.72	0.49	0.84
Ash + SO_3	7.43	14.04	7.29	13.00	6.63	13.32
Elemental Analysis, Wt %						
SiO_2	14.39	39.32	24.23	35.40	17.80	38.82
SiO_2(2)	15.38	44.31	26.52	40.83	19.22	43.70
SO_3	6.45	11.27	8.63	13.29	7.41	11.17
Na_2O	1.65	0.92	1.46	0.90	1.65	0.91

(1) Dry basis
(2) SO_3 free ash basis

Table 22-4. RAW VELVA LIGNITE SAMPLES (AS RECEIVED FROM MINE)

Date	1/18/75	1/19/74	← 1/20/74 →					
Sample No.	5877	5918	5925	5933	5947	5953	5960	5968
Screen Size, Wt % Tyler Mesh -100	8.2	5.9	4.5	2.4	3.3	14.4	13.0	4.6
Analyses, Wt %								
Ash (SO_3 Free)	5.17	7.90	6.23	5.55	6.62	7.29	7.02	6.01
SiO_2 in Ash	32.56	27.05	24.02	22.72	21.41	27.21	28.65	24.25
SiO_2 in Sample	1.68	2.14	1.67	1.26	1.42	1.99	2.01	1.46

Date	← 1/21/75 →				← 1/22/75 →				
Sample No.	5979	5985	5992	6003	6009	6017	6023	6046	6054
Screen Size, Wt % Tyler Mesh -100	15.6	6.8	13.4	9.3	33.2	22.6	23.3	11.3	23.5
Analyses, Wt %									
Ash (SO_3 Free)	8.13	7.16	9.27	6.46	11.08	10.09	9.48	8.71	9.92
SiO_2 in Ash	30.80	27.97	34.68	28.80	43.55	39.10	39.26	33.92	36.85
SiO_2 in Sample	2.50	2.00	3.21	1.86	4.83	3.95	3.72	2.96	3.65

Table 22-5. GROUND VELVA LIGNITE ANALYSES (Sheet 1 of 2)

Date	← 1/23/75 →				1/24/75	1/25/75
Sample No.	6060	6064	6081	6089	6099	6103	6174
Screen Size, Wt % Tyler Mesh -100	16.5	15.3	9.1	13.6	10.7	14.8	12.4
Analyses, Wt %							
Ash (SO_3 Free)	9.90	8.40	7.11	10.30	7.42	9.17	8.49
SiO_2 in Ash	38.02	37.21	35.56	33.77	28.14	38.53	37.20
SiO_2 in Sample	3.76	3.13	2.53	3.48	2.09	3.53	3.16

Date	← 2/2/75 →			2/3/75		← 2/4/75 →		
Sample No.	6353	6354	6384	6385	6419	6444	6468	6477	6486
Screen Size, Wt % Tyler Mesh -100	17.8	16.0	15.5	4.3	14.9	9.6	3.8	4.4	5.8
Analyses, Wt %									
Ash (SO_3 Free)	8.49	8.74	7.87	6.55	8.78	6.56	6.09	6.93	7.87
SiO_2 in Ash	36.73	34.87	35.23	28.86	30.56	26.52	30.22	38.22	32.87
SiO_2 in Sample	3.12	3.05	2.77	1.89	2.68	1.74	1.84	2.65	2.59

Table 22-5. GROUND VELVA LIGNITE ANALYSES (Sheet 2 of 2)

Date	← 9/25/74 →			← 9/26/74 →		
Time	0700	1500	2300	0700	1510	1700
Jacket Steam Make, lb/hr	0	0	0	0	0	0
Solids						
Feedstock	Husky Char		← Velva Lignite →			
Feed Rate, lb/hr[1]	2,420	0	1,660	1,710	2,020	2,770
Dump Acceptor, lb/hr	360	360	← 311 →			
Gas Flows[2]						
Boot (Recycle), SCFH	32 ?00	20,600	13,600	24,700	7,090	0
Boot (Steam), SCFH	0	7,480	16,100	14,700	31,100	41,300
Steam to Side, SCFH	30,900	31,100	19,500	20,700	24,700	24,900
Air to Side, SCFH	14,700	25,600	23,900	24,600	23,500	25,300
Purges						
Recycle, SCFH	4,353	4,049	4,085	4,022	4,183	4,237
Inert, SCFH	387	387	387	387	387	387
Total Flow In, SCFH	83,240	89,216	77,572	89,109	90,960	96,124
Vent Rate, SCFH	23,800	48,300	64,900	59,700	73,400	Off Scale
Bed Conditions						
Boot Velocity, ft/sec	1.40	1.40	1.58	2.07	2.02	2.15
Char Bed Velocity Inlet, ft/sec	0.71	0.87	0.79	0.90	0.93	0.98
Boot Density, lb/ft^3[3]	78	96	93	92	90	87
Char Bed Density, lb/ft^3[3]	44	42	41	42	41	36
Boot Temperature, °F	1120	1390	1505	1493	1497	1470
Char Bed Temperature, °F	1186	1409	1516	1491	1505	1498
Overhead Gas Compositions, Mol %						
CO	3.7	16.3	21.4	18.6	26.5	26.5[5]
CO_2	21.9	23.4	12.4	14.5	17.1	17.1
N_2	57.2	26.7	32.8	35.1	23.2	23.2
H_2	11.0	30.0	29.3	26.4	26.6	26.6
CH_4	6.1	3.6	4.1	5.4	6.6	6.6
H_2O Mol Fraction[4]	24.2	26.8	15.1	17.1	15.0	14.8

(1) Determined by feeder RPM. PPH = 504*RPM-100
(2) Determined by orifice flow meter measurements
(3) Determined by differential pressure measurements
(4) Calculated by water gas shift equilibrium
(5) Gas analysis for 1510 hrs assumed

Table 22-6. GASIFIER DATA, RUN 22A

Date	9/25/74			9/26/74		
Time	0700	1500	2300	0700	1510	1700
Jacket Steam Make, lb/hr	270	270	270	320	320	340
Solids	Dead-Burned Dolomite					
Acceptor Feedstock	327	352	727	533	533	424
Acceptor Makeup, lb/hr	6,120	6,670	11,100	9,450	15,300	14,700
Acceptor Circulation, lb/hr(1)	55	-	-	16	93	93
Ash & Attrited Acceptor, lb/hr(2)						
Gas Flows(3)						
Acceptor Lift, SCFH	58,200	57,000	56,400	57,200	56,400	56,700
Char Lift, SCFH	7,720	7,790	7,800	6,730	7,440	7,570
Air Line						
Recycle, SCFH	69,900	72,600	23,300	53,200	36,100	29,800
Air, SCFH	0	0	51,500	38,800	59,800	63,600
Purges						
Recycle, SCFH	435	428	424	431	425	427
Inert, SCFH	1,480	1,480	1,480	1,480	1,480	1,480
Nitrogen, SCFH	1,377	1,472	1,472	1,377	1,520	1,520
Total Flow In, SCFH	139,112	140,770	142,376	159,218	163,165	161,097
Vent Rate, SCFH	7,280	7,070	61,900	41,800	73,900	77,700
Bed Conditions						
Gas Velocity Inlet, ft/sec	1.76	1.87	2.61	2.70	2.97	2.98
Bed Density, lb/ft^3(4)	108	107	105	105	102	104
Average Bed Temperature, °F	1141	1188	1855	1680	1834	1870
Overhead Gas Analyses, Mol %						
O_2	0.0	0.0	0.0	0.0	0.0	0.0
CO	0.6	0.8	1.7	1.7	1.4	2.8
CO_2	9.6	15.0	18.5	12.8	18.0	16.0
N_2	89.8	84.2	79.8	85.5	80.6	81.2

(1) Determined by lift line pressure drop measurements
(2) Determined by weigh scale measurements
(3) Determined by orifice flow meter measurements
(4) Density indicated by pressure tap readings

Table 22-7. REGENERATOR DATA, RUN 22A

Date	11/27/74		← 11/28/74 →			11/29/74	
Time	1500	2300	0700	1500	2300	0700	1500
Jacket Steam Make, lb/hr	35	35	32	32	26	24	26
Solids							
Feedstock	← Husky Char →						Velva Lignite
Feed Rate, lb/hr(1)	1,390	860	1,360	2,420	1,660	1,410	1,410
Dump Acceptor, lb/hr	539	449	481	538	538	340	603
Purged Char, lb/hr	-	-	-	93	93	0	0
Gas Flows(2)							
Boot (Recycle), SCFH	40,000	23,900	27,200	25,700	30,000	25,800	19,500
Boot (Steam), SCFH	0	9,550	10,800	8,950	10,000	11,700	15,600
Steam to Side, SCFH	24,100	24,100	24,700	32,800	32,700	22,800	22,100
Air to Side, SCFH	14,900	15,200	15,600	15,000	13,800	14,600	15,000
Purges							
Recycle, SCFH	3,700	4,090	3,520	3,740	3,800	3,760	3,950
Inert, SCFH	387	387	387	387	387	387	387
Total Flow In, SCFH	83,087	77,227	82,207	86,577	90,687	79,041	76,537
Vent Rate, SCFH	31,300	37,500	27,900	40,000	31,000	32,600	34,600
Bed Conditions							
Boot Velocity, ft/sec	1.56	1.70	1.91	1.75	2.03	1.99	1.82
Char Bed Velocity Inlet, ft/sec	0.71	0.77	0.79	0.84	0.90	0.81	0.75
Boot Density, lb/ft^3(3)	90	98	98	92	99	98	99
Char Bed Density, lb/ft^3(3)	40	46	40	39	40	43	37
Boot Temperature, °F	1254	1425	1402	1412	1417	1509	1457
Char Bed Temperature, °F	1319	1467	1393	1412	1452	1509	1450
Overhead Gas Compositions, Mol %							
CO	6.0	16.0	8.0	11.0	14.0	18.0	14.4
CO_2	15.0	17.3	22.4	23.2	20.8	16.9	19.8
N_2	59.0	28.3	44.6	32.7	28.5	28.8	28.3
H_2	17.6	34.4	22.4	28.3	32.5	32.5	31.1
CH_4	2.4	4.0	2.9	4.8	4.3	3.9	6.3
H_2O Mol Fraction	23.4	26.2	34.0	33.8	30.9	24.0	28.4

(1) Determined by feeder RPM. PPH = 504*RPM-100
(2) Determined by orifice flow meter measurements
(3) Determined by differential pressure measurements

Table 22-8. GASIFIER DATA, RUN 22B

Date	1/27/74		← 11/28/74 →			11/29/74	
Time	1500	2300	0700	1500	2300	0700	1500
Solids	← Dead-Burned Dolomite →						
Acceptor Feedstock	327	727	327	327	327	363	363
Acceptor Makeup, lb/hr (1)	4,170	8,340	7,230	6,950	6,950	11,400	12,800
Acceptor Circulation, lb/hr (2)	100	39	39	78	67	80	114
Ash & Attrited Acceptor, lb/hr							
Gas Flows (3)							
Acceptor Lift, SCFH	58,300	57,600	59,100	58,400	58,200	48,900	49,000
Char Lift, SCFH	7,630	7,660	7,660	7,550	7,580	7,600	7,560
Air Line							
Recycle, SCFH	66,400	53,000	55,400	50,600	33,600	27,300	43,100
Air, SCFH	15,100	56,600	13,400	32,800	56,700	51,700	49,400
Purges							
Recycle, SCFH	428	425	429	428	424	423	425
Inert, SCFH	1,480	1,480	1,480	1,480	1,480	1,480	1,480
Nitrogen, SCFH	1,690	1,320	1,690	1,690	1,680	1,660	1,690
Total Flow In, SCFH	151,028	178,085	141,159	152,948	159,664	139,063	152,655
Vent Rate, SCFH	19,400	68,000	24,800	40,200	68,800	60,000	58,600
Bed Conditions							
Gas Velocity Inlet, ft/sec	2.08	3.23	2.02	2.40	2.92	2.54	2.56
Bed Density, lb/ft^3 (4)	104	105	101	101	96	99	104
Average Bed Temperature, °F	1284	1824	1354	1522	1847	1854	1662
Overhead Gas Analyses, Mol %							
O_2	0.0	0.0	0.0	> 2.5	0.0	0.0	0.0
CO	0.9	4.5	0.3	0.0	2.5	3.6	3.0
CO_2	15.0	18.0	14.5	14.4	19.0	20.0	17.6
N_2	84.1	77.5	85.2	83.1	78.5	76.4	79.4

(1) Determined by lift line pressure drop measurements
(2) Determined by weigh scale measurements
(3) Determined by orifice flow meter measurements
(4) Density indicated by pressure tap readings

Table 22-9. REGENERATOR DATA, RUN 22B

Date	← 12/18/74 →			← 12/19/74 →			← 12/20/74 →		
Time	0800	1500	1900	0700	1500	2300	0700	1500	2300
Jacket Steam Make, lb/hr	0	0	0	0	0	0	0	0	0
Solids									
Feedstock	Husky Char	←			Velva Lignite			→	
Feed Rate, lb/hr[1]	1,920	1,710	1,410	1,660	1,920	2,170	1,920	2,670	1,440
Dump Acceptor, lb/hr	184	255	644	274	289	281	438	270	270
Purged Char, lb/hr	65	27	27	74	74	22	15	15	-
Gas Flows[2]									
Boot (Recycle), SCFH	22,200	19,200	19,700	20,900	16,300	17,700	18,100	21,100	14,000
Boot (Steam), SCFH	15,500	13,100	13,300	14,900	18,800	19,700	21,100	15,800	23,200
Boot (CO_2), SCFH	0	0	0	0	0	0	0	0	536
Steam to Side, SCFH	22,700	22,000	23,400	23,300	19,400	20,100	15,600	20,700	15,500
Air to Side, SCFH	14,500	14,900	14,600	14,900	15,200	15,200	9,010	14,800	0
Purges									
Recycle, SCFH	5,070	5,380	5,120	5,050	4,920	4,970	5,410	4,820	5,750
Inert, SCFH	387	387	387	387	387	387	387	387	387
Total Flow In, SCFH	80,357	74,967	76,507	79,437	75,007	78,057	69,607	77,607	59,373
Vent Rate, SCFH	36,200	55,600	56,100	51,000	57,900	56,400	45,000	40,200	23,900
Bed Conditions									
Boot Velocity, ft/sec	1.96	1.69	1.74	1.87	1.83	1.95	2.07	1.95	1.96
Char Bed Velocity Inlet, ft/sec	0.77	0.75	0.76	0.79	0.75	0.78	0.69	0.77	0.57
Boot Density, lb/ft^3[3]	104	102	101	102	110	107	102	101	96
Char Bed Density, lb/ft^3[3]	42	43	37	32	34	32	33	33	34
Boot Temperature, °F	1469	1483	1490	1467	1470	1475	1499	1495	1495
Char Bed Temperature, °F	1431	1511	1512	1491	1503	1499	1511	1495	1503
Overhead Gas Compositions, Mol %									
CO	13.4	17.2	17.0	18.0	18.1	17.6	16.4	16.0	13.6
CO_2	20.6	19.7	19.2	20.0	20.4	15.9	12.2	14.5	13.2
N_2	28.8	22.2	23.7	19.2	18.0	18.5	14.8	19.7	1.4
H_2	33.6	35.2	34.7	36.4	37.0	40.3	47.3	41.3	59.6
CH_4	3.6	5.5	5.4	6.4	6.5	7.7	9.3	8.6	12.1
H_2O Mol Fraction	31.5	29.6	29.0	28.8	30.0	27.0	26.8	27.4	37.2

(1) Determined by feeder RPM. PPH = 504*RPM-100
(2) Determined by orifice flow meter measurements
(3) Determined by differential pressure measurements

Table 22-10. GASIFIER DATA, RUN 22C

Date	← 12/18/74 →			← 12/19/74 →			← 12/20/74 →		
Time	0800	1500	1900	0700	1500	2300	0700	1500	2300
Jacket Steam Make, lb/hr	210	200	210	270	290	280	200	180	220
Solids	← Dead-Burned Dolomite →						Tymochtee Dolomite		
Acceptor Feedstock	327	327	327	327	545	727	600	600	600
Acceptor Makeup, lb/hr	7,880	12,400	13,100	12,100	16,300	12,200	11,400	9,550	11,700
Acceptor Circulation, lb/hr(1)	68	108	88	70	80	90	118	88	104
Ash & Attrited Acceptor, lb/hr(2)									
Gas Flows(3)									
Acceptor Lift, SCFH	59,600	58,500	59,000	59,000	52,100	51,500	51,300	51,100	51,100
Char Lift, SCFH	8,290	7,440	7,400	7,090	7,200	7,230	7,140	6,920	6,600
Air Line									
Recycle, SCFH	46,400	21,700	22,900	15,700	14,600	10,300	5,140	10,200	0
Air, SCFH	55,300	51,300	51,800	54,000	56,600	58,900	63,800	65,500	66,300
Purges									
Recycle, SCFH	425	422	423	423	423	419	416	416	415
Inert, SCFH	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480
Nitrogen, SCFH	2,350	1,920	2,040	1,810	1,160	970	1,080	810	710
Total Flow In, SCFH	173,845	142,762	145,093	139,503	133,563	130,799	130,356	136,426	126,605
Vent Rate, SCFH	76,700	67,200	66,100	71,400	70,700	75,800	87,900	90,800	90,700
Bed Conditions									
Gas Velocity Inlet, ft/sec	2.98	2.62	2.64	2.55	2.45	2.38	2.38	2.49	2.31
Bed Density, lb/ft^3(4)	98	101	104	98	99	96	95	89	83
Average Bed Temperature, °F	1708	1868	1845	1856	1857	1835	1847	1842	1841
Overhead Gas Analyses, Mol %									
O_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	6.1	1.3	2.5	2.8	1.0	3.1	2.4	1.7	1.1
CO_2	17.6	20.4	19.6	19.2	19.8	24.0	26.1	26.0	27.4
N_2	76.3	78.3	77.9	78.0	79.2	72.9	71.5	72.3	71.5

(1) Determined by lift line pressure drop measurements
(2) Determined by weigh scale measurements
(3) Determined by orifice flow meter measurements
(4) Density indicated by pressure tap readings

Table 22-11. REGENERATOR DATA, RUN 22C

Date	← 1/17/75 →			← 1/18/75 →			← 1/9/75 →			← 1/20/75 →		
Time	0700	1500	2300	0700	1500	2300	0700	1500	2300	0700	1500	2300
Jacket Steam Make, lb/hr	0	0	0	0	0	0	0	0	0	0	0	0
Solids												
Feedstock	Husky Char		←				Velva Lignite		→			
Feed Rate, lb/hr(1)	960	980	1,410	1,310	1,660	1,910	2,170	1,840	1,820	1,390	1,660	1,710
Dump Acceptor, lb/hr	450	450	640	590	590	460	610	400	330	160	470	470
Gas Flows(2)												
Boot (Recycle), SCFH	24,000	23,800	18,900	18,000	21,800	22,300	22,400	20,300	20,900	21,000	21,100	21,200
Boot (Steam), SCFH	9,100	9,790	17,200	17,700	16,100	17,200	16,400	19,900	19,500	18,700	19,500	19,700
Boot (CO_2), SCFH	0	0	0	0	0	0	0	481	476	464	464	481
Steam to Side, SCFH	23,200	22,900	24,700	19,800	24,100	21,900	22,000	21,400	21,800	23,300	28,200	28,000
Air to Side, SCFH	14,200	15,000	15,100	14,800	15,200	15,200	13,400	10,300	4,550	0	0	0
Purges												
Recycle, SCFH	3,400	3,380	3,510	3,560	3,520	3,570	4,880	3,840	4,050	4,660	4,340	5,580
Inert, SCFH	387	387	387	387	387	387	387	387	387	387	387	387
Total Flow In, SCFH	74,287	75,257	79,797	74,247	81,107	80,557	79,467	76,608	71,663	68,511	73,991	75,348
Vent Rate, SCFH	33,300	34,900	48,400	55,000	57,700	57,000	52,000	51,000	38,800	31,100	33,200	34,900
Bed Conditions												
Boot Velocity, ft/sec	0.92	1.62	1.79	1.81	1.90	2.00	1.99	2.11	2.13	2.09	2.16	2.15
Char Bed Velocity Inlet, ft/sec	0.57	0.72	0.79	0.74	0.81	0.80	0.78	0.77	0.72	0.68	0.74	0.73
Boot Density, lb/ft^3(3)	108	117	105	101	105	102	101	92	93	90	90	87
Char Bed Density, lb/ft^3(3)	50	43	43	39	39	39	37	39	41	43	46	40
Boot Temperature, °F	1408	1428	1483	1484	1487	1490	1529	1551	1519	1529	1515	1505
Char Bed Temperature, °F	1417	1429	1503	1495	1500	1499	1509	1544	1519	1530	1513	1502
Overhead Gas Compositions, Mol %												
CO	14.2	13.4	18.3	18.8	18.4	18.5	17.4	17.7	14.9	15.2	14.1	14.3
CO_2	25.9	16.6	15.3	15.4	18.4	16.6	13.8	13.4	13.5	12.6	13.7	9.9
N_2	29.2	38.7	29.5	25.1	22.5	22.4	20.5	17.3	11.2	4.8	2.8	3.7
H_2	26.5	27.5	33.2	35.0	34.7	35.5	40.3	43.8	49.4	55.6	56.6	58.1
CH_4	4.2	3.8	3.7	5.7	6.1	7.0	8.0	7.9	11.0	11.8	12.8	14.0
H_2O Mol Fraction	29.4	23.2	22.2	22.5	26.1	24.5	24.9	26.8	32.1	33.2	36.5	29.2

(1) Determined by feeder RPM. PPH = 504*RPM-100
(2) Determined by orifice flow meter measurements
(3) Determined by differential pressure measurements

Table 22-12. GASIFIER DATA, RUN 23 (Sheet 1 of 3)

Date	← 1/21/75 →			← 1/22/75 →			← 1/23/75 →			← 1/24/75 →		
Time	0700	1500	2300	0700	1500	2300	0700	1500	2400	0300	1500	2300
Jacket Steam Make, lb/hr	0	0	0	0	0	0	0	0	0	0	0	0
Solids												
Feedstock	← Velva Lignite →										Husky Char	
Feed Rate, lb/hr(1)	2,420	2,170	2,450	1,990	1,820	1,840	2,520	1,820	1,560	2,420	510	1,410
Dump Acceptor, lb/hr	350	430	230	350	180	400	240	350	540	500	270	270
Gas Flows(2)												
Boot (Recycle), SCFH	16,600	18,900	23,200	20,400	16,200	14,000	13,300	13,100	11,400	11,000	29,300	24,700
Boot (Steam), SCFH	24,800	19,900	19,500	24,300	25,200	29,600	30,200	31,000	31,200	31,400	9,200	11,900
Boot (CO_2), SCFH	479	477	513	539	510	499	500	0	0	0	0	0
Steam to Side, SCFH	25,200	25,800	23,300	26,200	26,100	20,000	20,700	19,400	20,100	20,100	20,200	30,200
Air to Side, SCFH	0	12,500	0	0	0	0	0	0	13,400	13,800	15,100	20,000
Purges												
Recycle, SCFH	6,150	5,640	6,530	6,790	6,740	6,630	6,670	6,470	5,670	5,470	4,900	5,560
Inert, SCFH	387	387	387	387	387	387	387	387	387	387	387	387
Total Flow In, SCFH	73,616	83,604	73,430	78,616	75,137	71,116	71,757	70,357	82,157	82,157	79,087	92,747
Vent Rate, SCFH	43,850	50,400	34,000	35,800	35,500	37,100	39,900	69,300	59,900	60,000	33,500	43,100
Bed Conditions												
Boot Velocity, ft/sec	2.11	1.99	2.20	2.22	2.19	2.14	2.11	2.04	1.95	1.92	1.94	1.87
Char Bed Velocity Inlet, ft/sec	0.69	0.78	0.69	0.73	0.72	0.65	0.65	0.62	0.75	0.75	0.77	0.91
Boot Density, lb/ft^3(3)	87	87	81	81	81	81	83	83	84	86	89	83
Char Bed Density, lb/ft^3(3)	40	41	39	41	41	41	41	42	44	46	47	43
Boot Temperature, °F	1497	1495	1478	1497	1514	1503	1488	1484	1470	1462	1436	1489
Char Bed Temperature, °F	1488	1488	1475	1496	1509	1506	1482	1490	1470	1464	1459	1483
Overhead Gas Compositions, Mol %												
CO	14.0	15.2	12.8	13.3	14.3	14.1	13.8	13.0	14.8	14.7	16.2	14.0
CO_2	9.4	11.7	8.6	8.0	8.6	9.2	9.1	11.0	13.6	14.8	7.7	18.7
N_2	7.1	19.2	3.8	3.9	3.2	2.9	3.0	3.0	14.5	17.8	35.8	30.6
H_2	55.5	44.1	57.6	60.4	60.2	60.2	58.1	59.2	48.1	44.1	36.0	32.7
CH_4	14.0	9.8	17.2	14.4	13.7	13.6	16.0	13.8	9.0	8.6	4.3	4.0
H_2O Mol Fraction	27.1	25.3	27.3	26.9	27.3	28.8	27.4	33.4	29.8	29.7	13.9	30.1

(1) Determined by feeder RPM. PPH = 504*RPM-100
(2) Determined by orifice flow meter measurements
(3) Determined by differential pressure measurements

Table 22-12. GASIFIER DATA, RUN 23 (Sheet 2 of 3)

Date	1/25/75		2/1/75		← 2/2/75 →			← 2/3/75 →			2/4/75
Time	0700	1500	1500	2300	0300	1500	2300	0700	1500	2300	0700
Jacket Steam Make, lb/hr											
Solids											
Feedstock	Velva Lignite		← Husky Char →			← Velva Lignite →				Husky Char	Velva Lignite
Feed Rate, lb/hr(1)	2,220	1,440	1,160	910	1,160	2,090	2,670	2,670	2,420	2,170	2,450
Dump Acceptor, lb/hr	230	230	680	680	54	120	390	410	54	54	54
Gas Flows(2)											
Boot (Recycle), SCFH	26,100	25,900	42,400	22,900	24,500	20,400	20,400	23,800	23,500	28,700	24,000
Boot (Steam), SCFH	12,700	20,800	0	18,300	18,800	18,600	18,700	20,000	20,600	19,400	18,700
Boot (CO_2), SCFH	0	0	0	0	0	445	445	410	413	439	450
Steam to Side, SCFH	29,600	36,500	22,700	22,600	31,500	30,900	31,300	32,000	28,800	30,800	32,300
Air to Side, SCFH	16,800	23,400	14,600	14,100	19,500	19,600	19,400	19,700	16,800	20,300	
Purges											
Recycle, SCFH	4,910	4,850	3,290	4,510	4,550	4,430	4,560	4,470	4,660	3,930	4,390
Inert, SCFH	387	387	387	387	387	387	387	387	387	387	387
Total Flow In, SCFH	90,497	111,837	83,377	82,797	99,237	94,762	95,192	100,767	95,160	103,956	80,227
Vent Rate, SCFH	54,100	62,200	16,100	40,100	58,200	72,000	59,500	81,800	71,300	58,900	67,900
Bed Conditions											
Boot Velocity, ft/sec	2.00	1.93	1.92	1.93	2.00	19.5	1.92	2.21	2.16	2.40	2.25
Char Bed Velocity Inlet, ft/sec	0.89	1.01	0.74	0.77	0.95	0.93	0.93	1.00	0.91	1.03	1.01
Boot Density, lb/ft^3(3)	80	80	84	87	84	81	80	80	78	81	77
Char Bed Density, lb/ft^3(3)	39	33	52	49	44	31	32	30	27	31	37
Boot Temperature, °F	1516	1442	1209	1395	1480	1505	1497	1517	1490	1475	1517
Char Bed Temperature, °F	1479	1436	1239	1420	1495	1495	1491	1508	1473	1474	1503
Overhead Gas Compositions, Mol %											
CO	15.1	12.6	6.5	13.6	15.5	17.8	18.6	20.4	18.2	17.1	15.7
CO_2	14.4	20.2	23.0	18.1	13.1	15.4	15.1	11.7	12.2	13.3	12.4
N_2	24.0	30.2	47.1	32.0	30.5	22.9	20.9	19.3	17.6	27.0	23.6
H_2	38.0	31.5	16.4	31.1	36.8	37.1	37.9	41.0	43.4	37.2	40.3
CH_4	8.5	5.5	7.0	5.2	4.1	6.8	7.6	7.6	8.6	5.4	8.0
H_2O Mol Fraction	26.2	31.2	24.7	26.5	23.9	24.5	23.6	19.6	22.0	21.9	24.6

(1) Determined by feeder RPM. PPH = 504*RPM-100
(2) Determined by orifice flow meter measurements
(3) Determined by differential pressure measurements

Table 22-12. GASIFIER DATA, RUN 23 (Sheet 3 of 3)

Date	← 1/17/75 →			← 1/18/75 →			← 1/19/75 →		
Time	0700	1500	2300	0700	1500	2300	0700	1500	2300
Jacket Steam Make, lb/hr[4]	250	300	270	220	330	300	300	230	280
Solids									
Acceptor Feedstock	← Dead-Burned Dolomite →					← Tymochtee Dolomite →			
Acceptor Makeup, lb/hr[1]	360	370	370	370	370	600	600	600	600
Acceptor Circulation, lb/hr[2]	8,710	11,800	12,500	12,500	13,000	12,900	12,700	10,700	10,400
Ash & Attrited Acceptor, lb/hr[3]	43	79	76	75	62	71	85	86	82
Gas Flows[4]									
Acceptor Lift, SCFH	57,900	58,200	57,800	57,900	57,700	57,300	56,900	56,500	56,500
Char Lift, SCFH	7,300	7,300	7,300	7,400	7,350	7,350	7,400	7,370	7,310
Air Line									
Recycle, SCFH	21,300	22,500	22,400	22,400	22,300	10,600	0	0	0
Air, SCFH	52,500	41,200	52,000	52,400	53,000	53,800	64,000	60,300	65,300
Purges									
Recycle, SCFH	428	428	425	426	424	420	418	415	415
Inert, SCFH	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480
Nitrogen, SCFH	877	1,400	1,160	1,720	1,690	1,660	1,570	1,500	1,020
Total Flow In, SCFH	141,785	132,508	142,565	143,726	143,944	132,610	131,768	127,565	132,025
Vent Rate, SCFH	66,900	54,800	62,200	62,000	63,700	72,800	84,000	82,100	89,200
Bed Conditions									
Gas Velocity Inlet, ft/sec	2.61	2.28	2.63	2.62	2.65	2.40	2.38	2.34	2.41
Bed Density, lb/ft^3[5]	87-120	88-120	85-115	81-117	81-114	79-112	76-112	64-103	70-103
Average Bed Temperature, °F	1862	1713	1862	1849	1868	1839	1830	1866	1848
Overhead Gas Analyses, Mol %									
O_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	4.7	4.7	1.7	1.4	2.7	2.7	4.3	1.0	1.7
CO_2	14.8	15.2	17.6	16.8	18.4	22.5	24.6	26.8	27.4
N_2	80.5	80.2	80.7	81.8	79.0	74.8	71.2	72.3	70.9

(1) Determined by feeder RPM for fresh acceptor - PPH = 300*RPM, for dead-burned dolomite - PPH = 367*RPM
(2) Determined by lift line pressure drop measurements
(3) Determined by weigh scale measurements
(4) Determined by orifice flow meter measurements
(5) Density indicated by pressure tap readings

Table 22-13. REGENERATOR DATA, RUN 23 (Sheet 1 of 4)

Date	← 1/20/75 →			← 1/21/75 →			← 1/22/75 →		
Time	0700	1500	2300	0700	1500	2300	0700	1500	2300
Jacket Steam Make, lb/hr[4]	250	290	320	340	330	260	280	250	250
Solids									
Acceptor Feedstock	← Tymochtee Dolomite →								
Acceptor Makeup, lb/hr[1]	600	600	600	600	600	600	600	600	600
Acceptor Circulation, lb/hr[2]	11,900	10,600	8,270	10,400	2,730	8,000	9,200	9,200	9,230
Ash & Attrited Acceptor, lb/hr[3]	87	92	84	110	87	125	100	138	83
Gas Flows[4]									
Acceptor Lift, SCFH	56,500	56,500	57,100	57,200	56,600	57,200	57,000	56,900	56,400
Char Lift, SCFH	7,220	7,140	7,460	7,150	7,410	7,350	7,360	7,340	7,400
Air Line									
Recycle, SCFH	0	0	0	0	0	0	0	0	0
Air, SCFH	66,900	65,800	66,300	67,900	65,300	71,300	69,800	69,800	71,500
Purges									
Recycle, SCFH	415	415	413	414	414	414	413	413	413
Inert, SCFH	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480
Nitrogen, SCFH	1,120	1,070	1,000	1,020	1,000	1,190	930	930	1,000
Total Flow In, SCFH	133,635	132,405	133,753	135,164	132,204	138,934	136,983	136,863	138,193
Vent Rate, SCFH	91,900	88,900	90,000	96,700	88,200	98,400	97,200	93,200	96,100
Bed Conditions									
Gas Velocity Inlet, ft/sec	2.45	2.40	2.46	2.47	2.44	2.53	2.50	2.51	2.54
Bed Density, lb/ft^3[5]	67-100	64-97	63-94	64-97	61-96	60-91	60-91	61-90	58-90
Average Bed Temperature, °F	1858	1827	1861	1842	1866	1841	1843	1855	1860
Overhead Gas Analyses, Mol %									
O_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	1.9	2.8	1.8	2.6	3.5	4.6	2.3	2.0	2.1
CO_2	26.8	26.8	28.5	28.1	28.1	27.6	29.4	29.4	28.9
N_2	71.4	70.5	69.7	69.3	68.4	67.8	68.3	68.6	69.0

(1)
(2) Determined by feeder RPM for fresh acceptor - PPH = 300*RPM, for dead-burned dolomite - PPH = 367*RPM
(3) Determined by lift line pressure drop measurements
(4) Determined by weigh scale measurements
(5) Determined by orifice flow meter measurements
Density indicated by pressure tap readings

Table 22-13. REGENERATOR DATA, RUN 23 (Sheet 2 of 4)

Date	← 1/23/75 →			← 1/24/75 →			1/25/75	
Time	0700	1500	2400	0300	1500	2300	0700	1500
Jacket Steam Make, lb/hr(4)	250	260	290	330	320	330	280	310
Solids								
Acceptor Feedstock	← Tymochtee Dolomite →							
Acceptor Makeup, lb/hr(1)	600	600	900	1,200	1,200	435	600	300
Acceptor Circulation, lb/hr(2)	8,310	7,370	3,830	3,800	1,070	3,770	4,100	3,700
Ash & Attrited Acceptor, lb/hr(3)	117	90	98	118	57	104	101	75
Gas Flows(4)								
Acceptor Lift, SCFH	57,100	58,000	57,600	58,200	58,000	57,500	58,100	59,400
Char Lift, SCFH	7,270	7,330	7,330	7,270	7,260	7,340	7,350	7,330
Air Line								
Recycle, SCFH	0	0	0	0	50,700	33,500	0	29,200
Air, SCFH	75,100	66,700	61,400	62,700	44,600	57,000	49,400	34,100
Purges								
Recycle, SCFH	414	413	414	414	420	416	418	422
Inert, SCFH	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480
Nitrogen, SCFH	880	850	760	660	880	1,160	1,830	1,880
Total Flow In, SCFH	142,244	134,773	128,984	130,724	163,340	158,396	118,578	133,812
Vent Rate, SCFH	101,000	93,500	87,700	84,900	61,900	79,200	71,400	47,300
Bed Conditions								
Gas Velocity Inlet, ft/sec	2.62	2.46	2.37	2.41	2.88	2.83	2.15	2.32
Bed Density, lb/ft^3(5)	63-93	69-90	64-90	66-91	46-102	61-97	63-87	64-85
Average Bed Temperature, °F	1855	1845	1856	1856	1754	1787	1847	1737
Overhead Gas Analyses, Mol %								
O_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	4.0	2.1	2.6	2.2	1.6	2.6	3.6	1.7
CO_2	28.1	29.0	28.1	28.1	22.1	25.9	24.6	20.0
N_2	67.9	69.0	69.3	69.8	76.3	71.5	71.8	78.3

(1) Determined by feeder RPM for fresh acceptor - PPH = 300*RPM, for dead-burned dolomite - PPH = 367*RPM
(2) Determined by lift line pressure drop measurements
(3) Determined by weigh scale measurements
(4) Determined by orifice flow meter measurements
(5) Density indicated by pressure tap readings

Table 22-13. REGENERATOR DATA, RUN 23 (Sheet 3 of 4)

Date	← 2/1/75 →		← 2/2/75 →			← 2/3/75 →			2/4/75
Time	1500	2300	0300	1500	2300	0700	1500	2300	0700
Jacket Steam Make, lb/hr(4)	0	0	190	290	270	350	370	350	320
Solids									
Acceptor Feedstock	← Reconditioned Stone →				← Tymochtee Dolomite →				
Acceptor Makeup, lb/hr(1)	600	300	0	0	0	600	600	300	600
Acceptor Circulation, lb/hr(2)	4,290	6,250	5,930	8,320	11,600	12,800	8,710	4,940	8,930
Ash & Attrited Acceptor, lb/hr(3)	133	78	17	47	88	140	117	83	113
Gas Flows(4)									
Acceptor Lift, SCFH	58,700	56,200	56,700	56,400	56,000	55,500	55,700	56,400	55,800
Char Lift, SCFH	7,180	7,770	7,720	7,440	7,440	7,380	7,410	7,430	7,480
Air Line									
Recycle, SCFH	68,100	35,200	0	15,600	15,500	0	0	22,800	0
Air, SCFH	23,200	61,400	46,000	51,500	68,800	70,100	67,100	59,500	66,600
Purges									
Recycle, SCFH	429	418	417	416	415	412	414	416	410
Inert, SCFH	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480
Nitrogen, SCFH	1,880	1,020	1,160	1,730	1,810	1,640	1,310	1,280	1,380
Total Flow In, SCFH	160,969	163,488	113,477	134,566	151,445	136,512	133,414	149,306	133,150
Vent Rate, SCFH	24,100	84,000	68,600	69,300	93,900	99,300	93,600	72,000	94,700
Bed Conditions									
Gas Velocity Inlet, ft/sec	1.88	2.89	2.1	2.47	2.73	2.47	2.42	2.68	2.43
Bed Density, lb/ft3(5)	88-99	73-103	81-106	72-100	76-108	72-103	72-100	66-100	66-96
Average Bed Temperature, °F	1014	1762	1870	1866	1824	1833	1829	1800	1852
Overhead Gas Analyses, Mol %									
O_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	1.1	3.7	2.2	2.2	3.1	2.2	3.1	3.5	2.0
CO_2	14.4	24.6	25.0	25.9	27.2	30.3	28.5	26.3	31.7
N_2	84.5	71.7	72.7	72.0	69.8	67.5	68.4	70.1	66.3

(1) Determined by feeder RPM for fresh acceptor - PPH = 300*RPM, for dead-burned dolomite - PPH = 367*RPM
(2) Determined by lift line pressure drop measurements
(3) Determined by weigh scale measurements
(4) Determined by orifice flow meter measurements
(5) Density indicated by pressure tap readings

Table 22-13. REGENERATOR DATA, RUN 23 (Sheet 4 of 4)

Date 9/19/74 - 9/26/74

	Dolomite		Lignite	
Screen Size, Wt % Tyler Mesh	Dead-Burned (Average)	Screen Size, Wt % Tyler Mesh	Husky Char (Average)	Velva
+9	0.3	+6		
9 X 12	37.8	6 X 8		
12 X 20	55.9	8 X 10		Tr
-20	6.1	10 X 14		6.8
		14 X 20	28.8	10.6
		20 X 28		15.2
		28 X 35		16.9
		35 X 48	51.5	18.8
		48 X 65		13.2
		65 X 100	14.0	10.3
		100 X 200		6.2
		-200	5.8	2.0
Ultimate Analysis, Wt %(1)				
Moisture(2)				1.36
C				63.31
H				4.20
S				1.14
Ash + SO_3				11.07
Elemental Analysis, Wt %				
SiO_2				26.86
SO_3				15.20
Na_2O				1.14

(1) Dry basis
(2) As received

Table 22-14. FEEDSTOCK COMPOSITES, RUN 22A

Date 11/26/74 - 11/29/74

	Dolomite		Lignite	
Screen Size, Wt % Tyler Mesh	Dead-Burned (1)	Screen Size, Wt % Tyler Mesh	Husky Char (Average)	Velva Composite
+4	0.1	+6		
4 X 6	Tr	6 X 8		
6 X 8	0.3	8 X 10	.2	Tr
8 X 9	0.7	10 X 14	4.4	6.8
9 X 10	8.7	14 X 20	12.7	10.6
10 X 12	28.1	20 X 28	25.0	15.2
12 X 14	32.4	28 X 35	23.5	16.9
14 X 16	18.8	35 X 48	17.1	18.8
16 X 20	7.1	48 X 65	8.1	13.2
20 X 24	2.0	65 X 100	4.6	10.3
24 X 28	1.0	100 X 200	3.0	6.2
-28	0.8	-200	1.5	2.0
Ultimate Analysis, Wt %(2)				
Moisture(3)				1.36
C				63.31
H				4.20
S				1.14
Ash + SO_3				11.07
Elemental Analysis, Wt %				
SiO_2				26.86
SO_3				15.20
Na_2O				1.14

(1) One sample
(2) Dry basis
(3) As received

Table 22-15. FEEDSTOCK COMPOSITES, RUN 22B

Date 12/17/74 - 12/24/74

	Dolomite		Lignite	
Screen Size, Wt % Tyler Mesh	Dead-Burned[1]	Tymochtee	Screen Size, Wt % Tyler Mesh	Husky Char	Velva
+4			+6	(Average)	
4 X 6		Screen Not Available	6 X 8	↓	0.25
6 X 8	0.2		8 X 10		9.2
8 X 9	0.2		10 X 14	22.4	10.5
9 X 10	5.5		14 X 20	↓	13.2
10 X 12	32.3		20 X 28		15.8
12 X 14	27.3		28 X 35	48.6	18.2
14 X 16	14.0		35 X 48	↓	12.5
16 X 20	10.2		48 X 65	16.2	10.2
20 X 24	1.6		65 X 100	↓	7.0
24 X 28	0.5		100 X 200	12.8	3.3
-28	8.2		-200		
Ultimate Analysis, Wt %[2]					
Moisture[3]					0
C					65.37
H					4.60
S					0.48
Ash + SO_3					10.21
Elemental Analysis, Wt %					
SiO_2		6.19			25.83
SO_3		0.62			10.12
Na_2O		0.07			1.14
CaO		56.74			38.05
MgO		37.26			13.24
K_2O		0.11			0.31
P_2O_5		0.02			0.14
Al_2O_3		1.54			9.13
Fe_2O_3		0.79			4.41
TiO_2		0.11			0.51

(1) Only one sample taken
(2) Dry basis
(3) As received

Table 22-16. FEEDSTOCK COMPOSITES, RUN 22C

Date 1/16/75 - 2/5/75

Screen Size, Wt % Tyler Mesh	Dolomite Dead-Burned (Average)	Dolomite Tymochtee	Screen Size, Wt % Tyler Mesh	Lignite Husky Char (Average)	Lignite Velva
+4	0.1	63.9	+6		
4 X 6			6 X 8		
6 X 8			8 X 10		
8 X 9			10 X 14		
9 X 10			14 X 20	23.7	27.4
10 X 12	20.1	32.6	20 X 28		
12 X 14			28 X 35		
14 X 16			35 X 48	53.2	51.3
16 X 20	65.0	3.5	48 X 65		
20 X 24			65 X 100	14.7	15.2
24 X 28	7.8	Tr	100 X 200		
-28	7.1	Tr	-200	8.4	6.1
Ultimate Analysis, Wt %(1)					
Moisture (as received)					0
C					64.87
H					3.97
S					0.52
Ash + SO_3				15.57	9.00
Elemental Analysis, Wt %					
SiO_2		5.98		26.57	28.74
SO_3		0.62		21.84	12.56
Na_2O		0.07			1.38
CaO		56.54			34.86
MgO		36.68			8.89
K_2O		0.13			0.36
P_2O_5		0.02			0.14
Al_2O_3		1.42			9.46
Fe_2O_3		0.80			4.56
TiO_2		0.10			0.44

(1) Dry basis

Table 22-17. FEEDSTOCK COMPOSITES. RUN 23

	Calcined Acceptor Return		Recarbonated Acceptor Return
Date	11/27/74	11/28/74	11/27/74
Time	0245	2000	0000
Screen Size, Wt % Tyler Mesh			
+4	0.1		
4 X 6	Tr		0.3
6 X 8	0.3	1.0	0.4
8 X 9	0.7	2.4	8.3
9 X 10	8.7	13.4	27.3
10 X 12	28.1	31.2	32.9
12 X 14	32.4	31.1	19.3
14 X 16	18.8	13.6	6.9
16 X 20	7.1	4.2	2.0
20 X 24	2.0	1.1	1.1
24 X 28	1.0	1.0	1.3
-28	0.8	1.1	

Table 22-18. CIRCULATED ACCEPTOR, RUN 22B

	Calcined Acceptor Return			Recarbonated Acceptor Return		
Date	12/19/74	← 12/20/74 →		← 12/19/74 →		
Time	2130	1000	1615	2200	0800	1600	2000
Screen Size, Wt % Tyler Mesh							
+4							
4 X 6	2.1	5.4	4.4	3.6	0.5	0.5	0.3
6 X 8	3.0	9.8	9.0	6.7	1.2	1.3	1.1
8 X 9	12.9	19.5	19.0	15.9	8.5	12.2	10.7
9 X 10	32.9	29.1	27.1	25.0	30.9	30.5	31.0
10 X 12	26.0	20.5	21.1	21.0	31.2	29.2	30.2
12 X 14	11.5	8.4	10.7	11.4	17.1	16.4	16.1
14 X 16	5.1	3.3	4.2	5.1	8.0	7.4	7.8
16 X 20	1.2	0.8	1.0	1.4	1.4	1.4	1.5
20 X 24	0.8	0.8	0.9	1.5	0.8	0.7	0.4
24 X 28	4.4	2.3	2.1	8.1	0.3	0.4	1.0
-28							

Table 22-19. CIRCULATED ACCEPTOR, RUN 22C

Date	1/18/75		← 1/19/75 →			← 1/20/75 →		
Time	1000	1600	0400	1600	2200	1000	1600	2200
Screen Size, Wt % Tyler Mesh								
+4								0.3
4 X 6								Tr
6 X 8	0.6		1.8	3.2	3.8	6.9	5.0	6.8
8 X 9	0.6	0.1	3.4	4.7	6.8	14.9	10.6	13.4
9 X 10	9.9	8.3	9.7	12.2	13.3	19.6	17.2	19.6
10 X 12	33.4	29.5	29.3	23.3	22.8	22.3	21.4	20.8
12 X 14	29.5	28.4	27.2	23.4	22.7	18.3	19.1	18.2
14 X 16	14.9	16.5	14.8	16.1	14.8	10.2	12.3	10.5
16 X 20	7.2	10.3	7.2	8.9	8.0	4.4	5.8	4.2
20 X 24	1.5	2.1	1.3	1.7	1.8	1.1	1.6	1.3
24 X 28	0.5	1.0	0.6	1.2	1.2	0.6	1.4	1.0
-28	1.8	3.7	4.7	5.2	4.6	1.8	5.3	3.9

Table 22-20. CIRCULATED ACCEPTOR, CALCINED ACCEPTOR RETURN, RUN 23 (Sheet 1 of 4)

Date	← 1/21/75 →			← 1/22/75 →			← 1/23/75 →		
Time	1000	1600	2200	1100	1535	2145	1000	1600	2140
Screen Size, Wt % Tyler Mesh									
+4									
4 X 6									
6 X 8	9.8	4.9	6.8	12.5	14.8	9.1	10.4	13.4	10.6
8 X 9	18.0	13.1	14.3	21.3	21.1	16.4	20.9	22.2	17.8
9 X 10	23.8	20.9	21.6	22.5	23.3	23.0	23.7	25.4	22.3
10 X 12	18.6	19.6	19.3	17.0	15.6	18.3	18.5	16.5	16.9
12 X 14	15.1	18.3	17.5	14.2	12.3	15.1	13.7	12.3	14.1
14 X 16	7.7	9.6	8.8	5.9	5.3	7.0	5.4	4.9	6.4
16 X 20	3.0	4.3	3.8	3.1	2.5	3.9	2.9	2.2	4.2
20 X 24	1.0	1.9	1.6	1.2	1.3	2.1	1.5	1.2	2.4
24 X 28	0.6	2.2	1.8	1.0	1.0	2.0	1.3	0.9	2.6
-28	2.4	5.3	3.8	1.4	2.8	3.2	1.8	1.0	2.8

Table 22-20. CIRCULATED ACCEPTOR, CALCINED ACCEPTOR RETURN, RUN 23 (Sheet 2 of 4)

Date	← 1/24/75 →			1/25/75		← 2/1/75 →		
Time	1000	1640	2200	0830	1605	1030	1600	2200
Screen Size, Wt % Tyler Mesh								
+4								
4 X 6								
6 X 8	6.8	7.2	6.7	4.3	10.8	5.0	6.5	6.3
8 X 9	16.0	14.4	15.2	12.5	19.5	18.8	18.4	12.6
9 X 10	21.5	18.2	22.2	22.8	23.9	26.6	28.8	18.5
10 X 12	18.1	16.0	20.3	19.7	18.5	21.3	25.2	25.5
12 X 14	15.6	14.5	13.9	13.6	12.0	10.8	12.1	19.3
14 X 16	8.1	7.0	6.0	7.6	6.1	5.2	4.0	10.7
16 X 20	6.7	6.0	4.6	6.3	4.4	3.8	2.0	5.7
20 X 24	4.7	4.0	2.8	3.7	2.2	1.8	0.8	0.9
24 X 28	1.4	4.3	2.7	2.9	1.4	1.7	0.6	0.3
-28	1.0	8.2	5.7	6.6	1.3	4.9	1.7	0.6

Table 22-20. CIRCULATED ACCEPTOR, CALCINED ACCEPTOR RETURN, RUN 23 (Sheet 3 of 4)

Date	← 5/25/75 →			← 5/26/7 →			5/27/75
Time	0700	1500	2300	0700	1500	2300	0700
Jacket Steam Make, lb/hr	200	200	200	200	200	200	200
Solids							
Acceptor Feedstock	← Dead-Burned Dolomite →						
Acceptor Makeup, lb/hr	300	300	300	300	300	150	150
Acceptor Circulation, lb/hr (1)	13,400	9,400	13,400	8,900	13,300	9,400	9,900
Ash & Attrited Acceptor, lb/hr (2)	125	65	70	60	55	55	-
Gas Flows (3)							
Acceptor Lift, SCFH	53,000	52,800	52,800	52,900	52,600	52,800	53,300
Char Lift, SCFH	9,700	9,800	9,800	9,700	9,800	9,700	9,900
Air Line							
Recycle, SCFH	22,300	21,200	21,200	21,200	21,100	22,200	34,200
Air, SCFH	55,900	54,000	54,000	55,300	54,700	40,900	44,800
Purges							
Recycle, SCFH	1,810	1,810	1,800	1,810	1,810	1,810	1,820
Nitrogen, SCFH	1,930	1,880	1,640	1,580	1,830	1,880	2,740
Total Flow In, SCFH	144,600	141,500	141,200	142,500	141,800	129,300	146,800
Vent Rate, SCFH	72,700	71,000	66,000	67,600	68,000	55,300	62,700
Bed Conditions							
Gas Velocity Inlet, ft/sec	2.63	2.56	2.56	2.59	2.58	2.34	2.58
Bed Density, lb/ft^3 (4)	97	95	95	95	94	98	93
Average Bed Temperature, °F	1841	1833	1830	1842	1843	1844	1785
Overhead Gas Analysis, Dry Mol %							
O_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	4.3	2.9	2.4	3.2	2.3	2.8	3.8
CO_2	18.4	18.7	20.0	19.6	19.6	18.8	16.4
N_2	77.3	78.4	77.6	77.2	78.1	78.4	79.8

(1) Determined by lift line pressure drop measurements
(2) Determined by weigh scale measurements
(3) Determined by orifice flow meter measurements
(4) Density indicated by pressure tap readings

Table 26-5. REGENERATOR DATA, RUN 26A (Sheet 2 of 2)

Date 5/18 - 5/27

	Dolomite		Lignite	
Screen Size, Wt % Tyler Mesh	Dead-Burned	Screen Size, Wt % Tyler Mesh	Husky Char	Velva
4 X 9	1.1	8 X 10	0.4	0.2
9 X 12	43.0	10 X 14	11.2	12.3
12 X 20	54.7	14 X 20	14.8	12.1
20 X 28	1.0	20 X 28	18.5	12.9
-28	0.2	28 X 35	18.3	13.8
		35 X 48	16.9	16.7
		48 X 65	11.9	12.6
		65 X 100	4.3	9.4
		100 X 200	3.0	6.3
		-200	0.7	3.7
Ultimate Analysis, Wt %(1)				
C			74.07	65.90
H			2.72	3.66
N			1.05	0.98
S			1.86	0.40
Ash + SO_3			14.50	8.04
Elemental Analysis, Wt %				
SiO_2			31.25	25.29
SO_3			23.52	11.49
Na_2O			1.78	1.21
CaO			23.84	36.97
MgO			5.75	9.08
K_2O			0.17	0.17
P_2O_5			Tr	Tr
Al_2O_3			9.90	9.28
Fe_2O_3			3.71	4.66
TiO_2			0.56	0.61

(1) Dry basis

Table 26-6. FEEDSTOCK COMPOSITES, RUN 26A

Date	5/22	5/24	5/24	5/26	5/27
Time	1620	0000	2000	0000	0000
Screen Size, Wt % Tyler Mesh					
+4					
4 X 6					
6 X 8	0.5	0.3	1.3	1.4	1.0
8 X 9	0.9	0.5	1.2	1.5	0.9
9 X 10	9.8	11.2	15.7	17.6	14.2
10 X 12	38.6	35.0	36.1	37.1	35.9
12 X 14	29.8	30.5	28.4	27.0	28.4
14 X 16	14.3	15.6	11.9	10.8	13.2
16 X 20	3.4	3.8	2.7	2.4	3.4
20 X 24	0.5	0.6	0.6	0.5	0.8
24 X 28	0.4	0.4	0.5	0.4	0.6
-28	1.8	2.0	1.6	1.5	1.5

Table 26-7. CIRCULATED ACCEPTOR, CALCINED ACCEPTOR RETURN, RUN 26A

Date	5/22	5/24	5/24	5/26	5/27
Time	1600	0000	0000	0000	0000
Screen Size, Wt % Tyler Mesh					
+4					
4 X 6		0.2	Tr	0.2	0.2
6 X 8	0.4	0.2	0.4	0.3	0.3
8 X 9	5.8	8.3	11.0	10.8	12.4
9 X 10	31.2	31.4	33.5	33.6	37.5
10 X 12	33.2	31.9	32.4	32.5	30.7
12 X 14	20.8	20.1	17.1	16.9	13.9
14 X 16	5.9	5.2	4.0	4.2	3.1
16 X 20	1.0	1.1	0.7	0.6	0.6
20 X 24	0.5	0.5	0.4	0.3	0.4
24 X 28	2.0	1.1	0.4	0.7	1.0
-28					

Table 26-8. CIRCULATED ACCEPTOR, RECARBONATED ACCEPTOR RETURN, RUN 26A

Date	← 5/22 →		← 5/23 →				← 5/24 →					
Time	2330		0945		2000		0400		1245		2000	
Fraction	Char	Acceptor	Char	Acceptor	Char	Acceptor	Char	Acceptor	Char	Acceptor	Char	Acceptor
Screen Size, Wt % Tyler Mesh												
+8							0.1		0.2		0.2	
8 X 10	3.0		0.8		1.1		2.8		1.4		2.2	
10 X 14	37.4	44.0	32.9	48.9	23.5	41.0	33.9	37.2	31.4	39.7	32.3	41.5
14 X 20	20.6	44.6	24.7	40.3	19.9	42.8	20.6	51.0	15.4	46.8	17.1	44.9
20 X 28	13.0	2.6	17.1	3.4	15.3	4.9	12.4	5.1	7.5	3.6	9.2	4.0
28 X 35	10.8	2.7	11.5	2.5	12.5	4.0	10.7	2.3	11.1	3.5	11.2	3.9
35 X 48	8.1	2.9	7.6	2.2	10.5	3.6	9.1	2.1	12.8	3.6	11.5	3.2
48 X 65	3.9	2.5	3.3	2.0	6.0	2.8	5.0	1.6	8.3	2.5	7.0	2.0
65 X 100	2.3	0.7	1.5	0.7	4.8	0.7	3.6	0.7	7.2	0.5	5.5	0.4
100 X 200	1.1		0.5		3.1	Tr	1.5		4.0		3.0	Tr
-200	Tr	Tr	Tr		3.4		0.3		0.8		0.8	
% Char	38.4		63.1		64.7		64.6		42.0		42.2	
Ash + SO_3	22.8		16.22		17.76		15.30		20.28		15.07	
Ash Elemental Analysis, Wt %												
SiO_2	23.50		5.01		27.08		23.40		6.53		24.66	
SO_3	17.07		17.90		9.61		11.19		4.76		2.17	
Na_2O											1.75	

*Samples taken from gasifier char bed

Table 26-9. REGENERATOR FUEL CHAR,* RUN 26A (Sheet 1 of 2)

Date	← 5/25 →								← 5/26 →				5/27
Time	0400		1200		1815		2000		0825		2000		0400
Fraction	Char	Acceptor	Char	Acceptor	Char	Acceptor	Char	Acceptor	Char	Acceptor	Char	Acceptor	Char
Screen Size, Wt % Tyler Mesh													
+8					0.6		0.1				0.3		
8 X 10	2.5		1.6		4.7		1.9		0.8		1.6		0.3
10 X 14	32.6	30.5	35.4	43.5	46.1	52.5	28.6	38.7	24.6	33.6	33.1	42.1	7.6
14 X 20	16.2	62.3	17.1	43.9	22.3	42.1	17.3	42.8	21.1	41.6	15.8	41.1	7.4
20 X 28	8.6	2.3	8.6	3.9	7.8	2.8	10.4	4.7	18.6	7.1	8.8	3.7	12.8
28 X 35	11.5	2.5	10.1	4.1	6.1	1.6	12.2	5.4	16.8	7.1	11.3	5.0	19.8
35 X 48	12.4	0.4	11.4	2.7	5.5	0.8	12.8	4.9	12.4	5.6	12.7	5.0	22.9
48 X 65	7.4	1.5	7.0	1.5	3.2	0.3	7.2	2.8	4.6	3.5	7.2	2.4	12.6
65 X 100	5.8	0.5	5.2	0.2	2.4	0.2	5.6	0.7	1.0	1.4	5.5	0.6	10.0
100 X 200	2.6		2.7	0.1	1.2		2.8				3.0		5.8
-200	0.2		0.9		0.1		1.2	Tr	Tr	Tr	0.8		0.9
% Char	39.1		37.2		33.6		41.4				38.2		
Ash + SO_3	18.03		14.60		11.17		14.81				15.11		
Ash Elemental Analysis, Wt %													
SiO_2	26.92		6.05		23.73		26.91				22.31		22.39
SO_3	0.08		1.25		4.96		1.31				1.24		0.49
Na_2O	1.75		1.47		1.63		1.77				1.60		1.76

*Samples taken from gasifier char bed

Table 26-9. REGENERATOR FUEL CHAR,* RUN 26A (Sheet 2 of 2)

Date	5/25	5/26
Time	Composite	Composite
Screen Size, Wt %		
Tyler Mesh		
+60	3.8	2.4
60 X 100	27.8	6.8
100 X 325	59.6	61.6
-325	8.8	29.1
Ultimate Analysis, Wt %		
H_2O	0	0
C	60.83	65.72
H	1.38	1.08
S	1.86	0.53
Ash + SO_3	29.61	25.57
Elemental Analysis, Wt %		
SiO_2	25.91	22.82
SO_3	9.24	8.14
Na_2O	1.36	1.22

Table 26-10. GASIFIER CHAR TO ORGANIC POND, RUN 26A

Date	← 5/22 →		← 5/23 →		← 5/24 →		← 5/25 →		5/26
Time	0615	2040	0245	1900	0710	1815	0015	0940	0130
Screen Size, Wt %									
Tyler Mesh									
+35	2.4	1.1	1.4	1.9	4.7	2.0	1.2	0.8	0.7
35 X 48	18.8	7.2	4.0	2.6	9.5	8.0	5.9	5.0	5.4
48 X 65	26.6	10.9	8.3	4.9	14.3	12.8	10.3	9.3	10.7
65 X 100	22.8	13.6	12.7	9.0	16.6	15.5	14.4	14.2	14.6
100 X 200	17.2	20.4	24.9	24.5	19.2	20.7	21.4	21.8	20.3
200 X 325	5.2	14.4	21.0	18.1	10.9	11.8	13.2	13.2	14.9
-325	7.0	32.3	27.7	38.9	24.7	29.2	33.5	35.8	33.4
% Calcine Weight Change									-6.1
Elemental Analysis, Wt %									
SiO_2							34.55		38.36
SO_3							5.33		2.86
Na_2O							1.46		1.48

Table 26-11. ASH AND ATTRITED ACCEPTOR, RUN 26A

Date	6/10/75		← 6/11/75 →			6/12/75		← 6/13/75 →			
Time	1500	2300	0700	1500	2300	0700	1500	0015	0700	1500	2300
Jacket Steam Make, lb/hr	0	0	0	0	0	0	0	0	0	0	0
Solids											
Feedstock	Char	←					Lignite				→
Feed Rate, lb/hr(1)	800	1,500	1,900	1,700	2,000	2,600	2,000	1,900	2,500	2,400	2,100
Dump Acceptor, lb/hr	380	290	530	590	310	550	590	390	180	380	400
Char Withdrawal, lb/hr	190	170	150	290	300	180	130	150	80	140	110
Gas Flows(2)											
Boot (Recycle), SCFH	25,800	28,100	26,000	23,000	23,300	20,400	20,900	20,000	26,400	21,500	22,300
Boot (Steam), SCFH	14,300	14,400	17,100	21,200	21,700	26,200	26,500	26,000	27,000	27,400	30,300
Steam to Side, SCFH	16,800	28,500	28,500	27,700	27,900	24,600	24,400	24,400	25,700	20,700	21,800
Air to Side, SVFH	19,600	19,500	19,700	19,500	18,500	12,300	10,100	9,800	9,000	0	0
Purges											
Recycle, SCFH	3,400	3,560	4,110	4,020	3,990	4,300	4,450	3,930	4,230	4,710	4,860
Inert, SCFH	230	230	230	230	230	230	230	230	230	230	230
Total Flow In, SCFH	80,100	94,300	95,600	95,700	95,600	88,000	86,600	84,400	92,100	74,500	79,500
Vent Rate, SCFH	43,100	60,500	60,800	77,900	76,100	74,200	70,100	65,000	65,800	50,800	50,700
Bed Conditions											
Boot Velocity, ft/sec	1.99	2.20	2.23	2.31	2.36	2.45	2.47	2.39	2.81	2.53	2.72
Char Bed Velocity Inlet, ft/sec	0.78	0.96	0.97	0.98	0.98	0.90	0.87	0.85	0.95	0.74	0.80
Boot Density, lb/ft^3(3)	104	96	96	92	84	86	83	78	83	78	78
Char Bed Density, lb/ft^3(3)	37	44	36	32	27	33	27	26	34	39	34
Boot Temperature, °F	1379	1456	1453	1476	1484	1487	1474	1462	1489	1460	1457
Char Bed Temperature, °F	1401	1490	1481	1509	1504	1508	1493	1488	1518	1493	1499
Overhead Gas Compositions, Dry Mol %											
CO	10.2	18.0	18.9	19.0	17.2	19.0	19.3	15.3	18.5	15.2	14.6
CO_2	16.8	15.2	11.6	11.5	11.1	8.9	7.9	13.5	8.3	8.1	7.3
N_2	40.4	26.3	26.1	22.7	22.5	15.7	14.4	18.5	13.6	4.1	3.7
H_2	28.8	35.0	36.7	40.4	42.4	47.5	49.2	44.2	49.5	59.4	62.2
CH_4	3.8	5.5	6.7	6.4	6.8	8.9	9.2	8.5	10.1	13.2	12.2
H_2O Mol Fraction(4)	28.4	22.8	18.1	20.2	21.9	18.7	16.8	28.0	19.0	24.2	24.0

(1) Determined by feeder RPM measurements (354*RPM = lb/hr)
(2) Determined by orifice flow meter measurements
(3) Density indicated by pressure tap readings
(4) Calculated assuming water gas shift equilibrium

Table 26-12. GASIFIER DATA, RUN 26B (Sheet 1 of 2)

Date	← 6/14/75 →			← 6/15/75 →			6/16/75
Time	0700	1500	2315	0700	1500	2300	0300
Jacket Steam Make, lb/hr	0	0	0	0	0	0	0
Solids							
Feedstock	←			Lignite			→
Feed Rate, lb/hr(1)	1,700	2,200	2,400	2,200	2,200	3,000	2,180
Dump Acceptor, lb/hr	360	210	210	190	100	340	340
Char Withdrawal, lb/hr	160	160	120	140	250	290	260
Gas Flows(2)							
Boot (Recycle), SCFH	23,400	23,700	15,000	15,100	14,300	13,900	14,100
Boot (Steam), SCFH	29,600	29,600	32,100	32,500	31,400	33,100	33,100
Steam to Side, SCFH	23,000	23,800	23,700	23,000	23,700	20,400	21,700
Air to Side, SCFH	0	0	0	0	0	0	0
Purges							
Recycle, SCFH	4,760	4,820	4,660	4,830	4,880	4,710	4,650
Inert, SCFH	230	230	230	230	230	230	230
Total Flow In, SCFH	81,000	82,200	75,700	75,700	74,500	72,300	73,800
Vent Rate, SCFH	44,600	49,900	49,200	49,600	49,900	50,900	51,200
Bed Conditions							
Boot Velocity, ft/sec	2.76	2.77	2.43	2.47	2.36	2.41	2.45
Char Bed Velocity Inlet, ft/sec	0.82	0.83	0.76	0.76	0.74	0.72	0.74
Boot Density, lb/ft^3(3)	75	75	72	74	75	77	77
Char Bed Density, lb/ft^3(3)	30	33	36	38	39	40	40
Boot Temperature, °F	1470	1463	1452	1465	1455	1437	1460
Char Bed Temperature, °F	1509	1498	1496	1509	1502	1481	1507
Overhead Gas Compositions, Dry Mol %							
CO	15.6	15.0	14.1	14.2	14.0	13.5	13.7
CO_2	6.9	7.4	8.2	8.3	8.3	9.0	8.5
N_2	4.6	3.7	5.0	4.4	4.3	7.2	3.7
H_2	60.9	60.0	58.6	59.4	59.0	57.3	59.6
CH_4	12.0	13.9	14.1	13.7	14.4	14.6	14.5
H_2O Mol Fraction(4)	21.8	23.1	25.6	26.5	26.4	27.3	27.6

(1) Determined by feeder RPM measurements (354*RPM = lb/hr)
(2) Determined by orifice flow meter measurements
(3) Density indicated by pressure tap readings
(4) Calculated assuming water gas shift equilibrium

Table 26-12. GASIFIER DATA, RUN 26B (Sheet 2 of 2)

Date	6/10/75		← 6/11/75 →			6/12/75		← 6/13/75 →			
Time	1500	2300	0700	1500	2300	0700	1500	0015	0700	1500	2300
Jacket Steam Make, lb/hr	250	250	250	250	250	230	250	240	230	240	250
Solids											
Acceptor Feedstock	Dead-Burned		← Tymochtee Dolomite →								
Acceptor Makeup, lb/hr	300	300	600	600	600	600	600	600	600	600	600
Acceptor Circulation, lb/hr(1)	200	5,000	5,800	9,400	10,000	8,600	9,500	13,700	15,600	14,600	15,100
Ash & Attrited Acceptor, lb/hr(2)	-	60	60	60	150	120	90	90	110	100	120
Gas Flows(3)											
Acceptor Lift, SCFH	57,600	56,600	57,000	57,400	57,200	56,800	57,100	57,600	56,300	57,800	52,100
Char Lift, SCFH	10,100	10,100	9,900	9,900	9,900	9,600	10,200	10,500	10,700	10,100	10,100
Air Line											
Recycle, SCFH	56,200	22,700	22,000	24,900	20,600	20,700	0	0	0	0	0
Air, SCFH	45,400	51,200	62,100	63,700	70,200	71,500	74,200	89,000	75,700	77,200	78,510
Purges											
Recycle, SCFH	1,820	1,770	1,800	1,790	1,780	1,780	1,780	1,780	1,780	1,780	1,770
Nitrogen, SCFH	2,400	1,880	1,980	2,510	2,400	2,130	2,080	2,080	2,340	2,030	1,880
Total Flow In, SCFH	173,500	144,300	154,800	160,200	162,100	162,500	145,400	161,000	145,800	148,900	144,400
Vent Rate, SCFH	57,600	61,800	79,000	86,500	96,200	98,600	100,200	130,800	98,400	106,900	104,600
Bed Conditions											
Gas Velocity Inlet, ft/sec	2.76	2.65	2.84	2.91	2.97	2.96	2.62	2.90	2.64	2.69	2.61
Bed Density, lb/ft^3(4)	104	102	100	94	92	87	82	78	77	77	75
Average Bed Temperature, °F	1552	1865	1862	1842	1863	1842	1830	1816	1839	1825	1834
Overhead Gas Analysis, Dry Mol %											
O_2	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	0.0	1.7	2.8	2.8	1.5	3.7	2.4	1.6	2.2	3.2	2.3
CO_2	15.9	27.6	21.2	23.7	25.0	24.6	26.3	26.3	25.9	26.3	27.2
N_2	81.8	70.7	76.0	73.5	73.5	71.7	71.3	72.1	71.9	70.5	70.5

(1)
(2) Determined by lift line pressure drop measurements
(3) Determined by weigh scale measurements
(4) Determined by orifice flow meter measurements
Density indicated by pressure tap readings

Table 26-13. REGENERATOR DATA, RUN 26B (Sheet 1 of 2)

Date	6/14/75			6/15/75			6/16/75
Time	0700	1500	2315	0700	1500	2300	0300
Jacket Steam Make, lb/hr	260	250	210	230	240	260	270
Solids							
Acceptor Feedstock	Tymochtee Dolomite						
Acceptor Makeup, lb/hr	600	600	600	600	600	600	600
Acceptor Circulation, lb/hr(1)	14,900	13,300	12,500	13,300	12,800	11,200	10,100
Ash & Attrited Acceptor, lb/hr(2)	110	120	100	120	110	120	70
Gas Flows(3)							
Acceptor Lift, SCFH	51,500	51,300	51,500	51,400	51,600	51,600	51,000
Char Lift, SCFH	10,300	10,200	9,800	9,800	10,100	10,100	9,900
Air Line							
Recycle, SCFH	0	0	0	0	0	0	0
Air, SCFH	83,300	79,100	76,500	77,300	74,700	78,600	75,700
Purges							
Recycle, SCFH	1,770	1,770	1,770	1,770	1,770	1,770	1,770
Nitrogen, SCFH	2,450	1,880	1,780	1,470	1,390	1,310	1,270
Total Flow In, SCFH	149,300	144,300	141,400	141,700	139,600	143,400	139,600
Vent Rate, SCFH	122,900	111,100	105,400	106,000	99,800	106,500	102,900
Bed Conditions							
Gas Velocity Inlet, ft/sec	2.71	2.64	2.58	2.60	2.55	2.62	2.56
Bed Density, lb/ft^3(4)	71	70	70	70	70	71	69
Average Bed Temperature, °F	1844	1858	1852	1860	1846	1846	1849
Overhead Gas Analysis, Dry Mol %							
O_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	2.6	1.7	3.6	2.4	2.4	3.1	2.2
CO_2	27.2	28.5	27.4	28.1	27.6	27.6	28.5
N_2	70.2	69.8	69.0	69.5	70.0	69.3	69.3

(1)
(2) Determined by lift line pressure drop measurements
(3) Determined by weigh scale measurements
(4) Determined by orifice flow meter measurements
Density indicated by pressure tap readings

Table 26-13. REGENERATOR DATA, RUN 26B (Sheet 2 of 2)

Date 6/9 - 6/16

	Dolomite		Lignite	
Screen Size, Wt % Tyler Mesh	Tymochtee	Screen Size, Wt % Tyler Mesh	Husky Char (Average)	Velva
6 X 8	33.9	6 X 8		Tr
8 X 9	29.0	8 X 10		0.9
9 X 10	23.0	10 X 14		12.8
10 X 12	9.5	14 X 20	23.9	14.3
12 X 14	3.4	20 X 28		14.6
14 X 16	0.8	28 X 35		14.0
16 X 20	0.2	35 X 48	52.7	15.5
20 X 24	Tr	48 X 65		11.8
24 X 28	Tr	65 X 100	15.7	8.2
-28	0.1	100 X 200		5.2
		-200	7.7	2.8
Ultimate Analysis, Wt %(1)				
Moisture(2)				1.12
C				64.59
H				5.10
S				0.42
Ash + SO_3				7.38
Elemental Analysis, Wt %				
SiO_2	5.15			26.03
SO_3	0.43			9.71
Na_2O	0.15			1.11
CaO	52.83			34.00
MgO	38.85			10.53
K_2O	0.04			0.05
P_2O_5	0.03			0.13
Al_2O_3	1.38			9.71
Fe_2O_3	0.69			4.86
TiO_2	0.02			0.36

(1) Dry basis
(2) As received

Table 26-14. FEEDSTOCK COMPOSITES, RUN 26B

Date	← 6/10 →			← 6/11 →		← 6/12 →				
Time	0745	1600	0000	0750	1600	0000	0800	1600	0000	0800
Screen Size, Wt %										
Retained on Tyler Mesh										
4										
6							0.1			
8			0.3	0.1			3.9			6.9
9	0.5	0.4	0.4	0.5	7.4	9.7	11.4	26.8	31.8	15.9
10	8.1		13.8	15.8			20.1			29.8
12	30.3	40.4	37.9	35.8	45.2	41.2	27.1	48.1	43.8	22.0
14	31.3		28.7	29.5			24.4			15.2
16	20.6		13.4	12.7			9.0			4.4
20	7.2	58.1	4.0	3.0	44.3	44.4	2.0	23.1	19.2	1.6
24	0.8		0.5	0.4			0.6			0.8
28	0.3	0.8	0.1	0.1	1.7	2.4	0.5	0.9	2.1	0.8
PAN	0.9	0.3	0.8	1.9	1.3	2.2	0.9	1.0	3.1	2.5
% Calcine Weight Change	-1.5			-0.1			-0.4			-0.7
Elemental Analysis, Wt %										
S=	0.01			0.03			0.04			Tr
SiO_2	1.28			2.07			5.18			6.80
SO_3	0.06			0.04			0.30			0.21

Table 26-15. CIRCULATED ACCEPTOR, CALCINED ACCEPTOR RETURN, RUN 26B (Sheet 1 of 2)

Date	6/13	← 6/14 →			← 6/15 →			6/16	
Time	1600	0000	0800	1600	0000	0800	1600	0000	0400
Screen Size, Wt % Retained on Tyler Mesh									
4									
6						0.1			
8			9.5			14.0			17.7
9	35.2	37.2	19.5	41.1	44.6	24.7	40.6	49.6	24.1
10			28.2			25.1			24.4
12	46.6	45.2	16.5	40.7	39.9	18.0	40.3	36.8	16.2
14			13.7			10.3			8.9
16			4.2			3.1			2.9
20	14.7	13.2	2.4	14.4	11.6	1.7	14.5	11.3	1.5
24			1.5			0.8			0.9
28	1.8	1.8	1.7	1.9	2.0	0.8	2.1	1.5	1.1
PAN	1.7	2.6	2.7	1.8	2.0	1.4	2.5	0.8	2.3
% Calcine Weight Change			-4.0			-0.6			-1.4
Elemental Analysis, Wt %									
S=			0.60			Tr			0.01
SiO_2			7.56			6.70			7.25
SO_3			0.42			0.42			0.41

Table 26-15. CIRCULATED ACCEPTOR, CALCINED ACCEPTOR RETURN, RUN 26B (Sheet 2 of 2)

Date	6/10	6/11	← 6/12 →				← 6/13 →			
Time	0800	0800	0000	0800	1200	2030	0400	0800	1200	2000
Screen Size, Wt % Retained on Tyler Mesh										
4										
6										
8	Tr	0.3	2.2	2.5				1.2		
9	1.0	1.0	3.9	7.3	11.5	14.4	15.7	14.5	18.4	21.0
10	16.7	8.4	15.3	22.9				29.1		
12	45.1	30.4	31.3	27.7	48.6	49.0	52.7	22.9	52.2	51.4
14	18.1	34.3	29.3	26.1				21.8		
16	12.4	18.6	13.4	10.2				7.1		
20	5.8	5.8	3.5	2.4	38.4	34.6	30.4	2.7	28.2	25.8
24	0.5	1.0	0.6	0.5				0.3		
28	Tr	0.1	0.2	0.2	1.4	1.5	1.1	Tr	1.2	1.4
PAN	0.4	0.1	0.4	0.3	0.1	0.4	0.1	0.4	0	0.4
Particle Density, lb/cu ft			182.9		165.8	172.9	170.3	160.4	162.5	156.2
% Calcine Weight Change	-1.0	-1.5	-4.0	-6.0	-5.4	-4.6	-7.9	-7.8	-8.4	-8.6
Activity			0.09	0.16	0.14	0.21	0.21	0.21	0.23	0.22
Elemental Analysis, Wt % S=	0.04	0.04		0.05						
SiO_2	1.00	2.39	2.57	3.97	3.91	5.78	3.93	5.11	5.17	5.55
SO_3	0.07	0.10	0.16	0.25	0.34	0.29	0.30	0.30	0.43	0.97
Na_2O										

Table 26-16. CIRCULATED ACCEPTOR, RECARBONATED ACCEPTOR RETURN, RUN 26B (Sheet 1 of 2)

Date	← 6/14 →				← 6/15 →				6/16
Time	0400	0800	1200	2000	0400	0800	1230	2025	0400
Screen Size, Wt % Retained on Tyler Mesh									
4									
6									
8		6.3				4.1			5.8
9	16.0	16.9	12.2	23.9	34.1	18.9	27.4	26.1	24.5
10		27.5				30.4			30.8
12	53.2	24.7	60.7	49.3	48.7	21.8	48.3	49.1	22.2
14		16.2				14.8			11.1
16		5.5				6.2			3.4
20	29.1	1.8	25.8	23.4	16.2	2.0	21.6	21.5	1.3
24		0.6				1.0			0.5
28	1.7	0.2	1.3	2.2	1.1	0.4	2.3	2.6	0.2
PAN	Tr	0.3	Tr	1.2	Tr	0.4	0.4	0.7	0.3
Particle Density, lb/cu ft	166.5		147.2	151.8	148.4		149.1	147.4	146.6
% Calcine Weight Change	-10.9	-10.3	-10.5	-11.0	-9.7	-11.5	-10.9	-11.3	-13.0
Activity	0.28	0.28	0.28	0.31	0.29	0.36	0.33	0.35	0.38
Elemental Analysis, Wt % S=		0.06				0.04			0.07
SiO_2	5.78	6.31	6.07	6.26	5.33	6.57	6.47	&.(c	8.49
SO_3	1.96	0.50	0.33	0.41	0.25	0.30	0.35	0.16	0.20
Na_2O									0.13

Table 26-16. CIRCULATED ACCEPTOR, RECARBONATED ACCEPTOR RETURN, RUN 26B (Sheet 2 of 2)

Date	← 6/10 →				← 6/11 →					
Time	1000		2000		0800		1300		1800	
Fraction	Char	Acceptor	Char	Acceptor	Char	Acceptor	Char	Acceptor	Char	Acceptor
Screen Size, Wt % Tyler Mesh										
+8			Tr		0.2		0.6		0.4	
8 X 10	Tr		1.3		2.6		4.6		2.7	
10 X 14	27.6	50.4	30.5	41.1	40.4	50.7	45.0	42.0	40.6	50.7
14 X 20	22.2	45.7	20.3	51.7	18.0	42.7	19.5	48.9	16.7	41.3
20 X 28	15.0	1.7	12.5	2.1	5.0	1.9	4.6	2.4	5.3	2.7
28 X 35	13.7	0.6	11.8	1.3	8.6	1.4	7.5	2.0	9.0	2.4
35 X 48	11.2	0.6	10.3	1.7	10.9	1.7	8.6	2.5	11.1	0.8
48 X 65	5.5	0.8	5.9	1.8	6.5	1.2	4.7	1.8	6.4	1.7
65 X 100	3.2	0.2	4.6	0.4	5.1	0.5	3.3	0.5	5.1	0.5
100 X 200	1.5		2.6		2.5	Tr	1.3		2.4	
-200	Tr		0.3		0.3		0.2		0.2	
% Char	51.7		53.2		29.6		26.0		35.7	
Ash + SO_3	13.45		19.53		18.03		17.62		17.52	
Ash Elemental Analysis, Wt % SiO_2	22.41		26.24		29.49		27.72		24.06	
SO_3	8.03		6.37		3.14		2.38		2.28	
Na_2O	1.55				1.92					

*Samples taken from gasifier char bed

Table 26-17. REGENERATOR FUEL CHAR,* RUN 26B (Sheet 1 of 4)

Date	← 6/12 →				← 6/13 →					
Time	1445		2140		0845		1415		2035	
Fraction	Char	Acceptor	Char	Acceptor	Char	Acceptor	Char	Acceptor	Char	Acceptor
Screen Size, Wt % Tyler Mesh										
+8	2.3		2.2		2.9		3.0		2.6	
8 X 10	12.2		11.0		19.2		22.4		10.6	
10 X 14	32.7	56.6	31.1	55.2	30.0	61.5	30.7	67.0	23.6	53.5
14 X 20	10.5	27.3	10.1	27.2	8.3	22.6	7.6	21.1	10.1	23.4
20 X 28	7.6	4.8	7.8	5.9	8.6	3.8	7.2	3.6	13.3	7.2
28 X 35	11.1	5.1	10.0	5.3	10.5	4.8	9.8	3.6	15.6	7.7
35 X 48	11.5	3.7	10.9	4.1	9.7	4.1	9.5	2.6	13.4	4.7
48 X 65	6.0	2.0	6.3	2.0	5.1	2.3	4.7	1.4	6.1	2.4
65 X 100	4.0	0.6	5.6	0.3	3.6	0.9	3.3	0.6	3.5	1.1
100 X 200	1.6		3.4		1.7		1.4		1.1	
-200	0.4		1.5		0.3		0.3		0.1	
% Char	40.1				41.4		35.6		57.8	
Ash + SO_3	14.54				18.56		15.72		12.60	
Ash Elemental Analysis, Wt % SiO_2	23.95				24.12		22.54		17.13	
SO_3	4.68				3.25		4.48		3.22	
Na_2O	1.79				1.41					

*Samples taken from gasifier char bed

Table 26-17. REGENERATOR FUEL CHAR,* RUN 26B (Sheet 2 of 4)

Date	← 6/14 →						← 6/15 →			
Time	0130		0800		1725		0010		0510	
Fraction	Char	Acceptor	Char	Acceptor	Char	Acceptor	Char	Acceptor	Char	Acceptor
Screen Size, Wt % Tyler Mesh										
+8	5.3		2.9		5.1		4.8		5.2	
8 X 10	23.2		14.8		18.0		21.9		21.1	
10 X 14	27.8	76.8	21.2	67.2	25.3	71.3	20.9	66.8	24.1	69.2
14 X 20	8.0	14.6	8.0	15.6	9.1	15.3	7.5	16.2	9.2	17.1
20 X 28	8.4	3.9	11.8	5.0	10.4	5.6	9.8	4.8	10.1	4.9
28 X 35	10.8	3.0	15.5	6.2	11.4	1.3	12.7	5.9	11.5	4.3
35 X 48	9.3	1.4	13.6	4.2	10.5	3.4	12.2	4.1	9.8	3.4
48 X 65	3.9	0.3	6.4	1.5	5.1	2.2	5.9	1.7	5.0	0.4
65 X 100	2.4		4.2	0.3	3.6	0.8	3.5	0.5	3.1	0.5
100 X 200	0.8		1.4		1.2	Tr	0.9		0.9	0.2
-200	0.1		0.2		0.2	Tr	Tr		Tr	Tr
% Char	23.4		48.1		49.7		39.2		36.2	
Ash + SO_3	11.71		18.08		13.94		15.30		11.54	
Ash Elemental Analysis, Wt %										
SiO_2	19.93		21.53		18.19		19.33		16.97	
SO_3	3.42		2.25		2.48		2.33		2.63	
Na_2O			1.48						1.04	

*Samples taken from gasifier char bed

Table 26-17. REGENERATOR FUEL CHAR,* RUN 26B (Sheet 3 of 4)

Date	← 6/15 →						← 6/16 →			
Time	1030		1730		2345		0250		0650	
Fraction	Char	Acceptor	Char	Acceptor	Char	Acceptor	Char	Acceptor	Char	Acceptor
Screen Size, Wt % Tyler Mesh										
+8	6.3		5.0		5.1		3.9		6.5	
8 X 10	28.0		22.2		23.3		23.9		19.7	
10 X 14	27.2	72.6	27.8	70.8	24.4	73.6	25.3	71.2	25.5	38.9
14 X 20	7.8	13.5	8.5	15.2	8.0	14.5	9.1	15.5	11.2	10.9
20 X 28	7.4	2.2	7.4	4.6	8.3	5.0	9.0	5.2	10.7	42.6
28 X 35	7.9	1.3	9.8	4.5	9.7	3.7	9.9	4.0	9.7	3.7
35 X 48	7.6	9.1	9.5	3.1	10.0	2.2	9.3	3.2	8.5	2.5
48 X 65	3.9	1.1	4.7	1.2	5.5	0.7	4.9	0.3	4.3	1.0
65 X 100	2.8	0.2	3.5	0.4	4.3	0.3	3.7	0.4	3.0	0.3
100 X 200	1.0		1.4	0.1	1.4		1.0	0.1	0.8	
-200	Tr		0.3	Tr	0.1		0		Tr	
% Char	32.6		34.4		31.5		32.1		44.4	
Ash + SO_3	13.52		12.10		11.15		11.42		12.33	
Ash Elemental Analysis, Wt % SiO_2	19.37		19.10		18.41		16.98		19.02	
SO_3	2.22		2.40		2.60		2.69		5.52	
Na_2O							1.13			

*Samples taken from gasifier char bed

Table 26-17. REGENERATOR FUEL CHAR*, RUN 26B (Sheet 4 of 4)

Date	6/10	6/11	6/12	6/13	6/14	6/15	6/16
Time	Composite	Composite	Composite	Composite	Composite	Composite	Composite
Screen Size, Wt %							
Tyler Mesh							
+60	1.4	3.5	23.3	0.3	0.3	1.9	7.1
60 X 100	3.1	18.0	23.4	4.2	1.1	8.5	21.0
100 X 325	67.9	63.4	45.7	33.8	28.3	49.0	45.9
-325	27.7	15.1	7.7	61.7	70.3	40.7	26.0
Ultimate Analysis, Wt %							
H_2O	0	0	0	0	0	0	0
C	57.95	61.24	52.27	57.80	56.14	62.54	64.54
H	1.99	1.14	1.78	1.30	1.12	1.19	1.20
S		0.65	0.61	0.92	0.49	0.51	0.41
Ash + SO_3	34.03	28.92	29.54	31.40	32.90	28.18	26.26
Elemental Analysis, Wt %							
SiO_2	40.84	25.55	22.21	24.00	22.66	25.29	23.96
SO_3	9.35	7.56	7.07	7.29	5.10	6.68	6.21
Na_2O	2.08	2.00	1.62	1.25	1.08	1.15	1.01

Table 26-18. GASIFIER CHAR TO ORGANIC POND, RUN 26B

Date	5/26	5/27	6/11		6/12		6/13		6/14		6/15	6/16	
Time	*	*	1225	*	1230	*	0925	*	1510	*	*	1700	*
Screen Size, Wt % Tyler Mesh													
+35	0.8	5.8	Tr	1.0	3.0	1.1	3.0	2.7	4.6	1.8	1.2	1.8	2.5
35 X 48	5.4	4.4	3.6	5.8	7.1	5.2	6.4	5.2	5.4	3.8	4.2	3.9	6.9
48 X 65	9.7	8.5	8.8	11.0	10.5	9.8	9.7	8.9	8.6	6.7	7.9	7.5	13.6
65 X 100	13.6	12.7	13.4	13.4	12.8	13.6	12.2	12.4	10.7	9.2	10.9	10.6	20.2
100 X 200	20.5	18.0	25.0	19.2	19.9	21.3	20.4	20.4	18.5	25.1	20.2	20.0	8.9
200 X 325	14.0	16.6	12.3	9.3	16.8	12.8	15.2	16.5	16.6	19.7	20.2	24.3	43.4
-325	36.0	33.9	37.0	40.4	29.9	36.2	33.0	33.8	35.6	33.6	35.3	31.9	4.5
% Calcine Weight Change	-6.1	-14.8		-18.5		-11.3		-5.0		-3.1	-3.3		-2.1
Elemental Analysis, Wt %													
SiO_2	38.36	33.56		33.85		32.84		15.37		27.15	27.80		23.74
SO_3	2.86	3.24		4.07		3.78		9.95		5.71	3.49		5.70
Na_2O	1.48	1.20		2.16		1.52		1.14		1.29	1.33		1.08
CaO				31.00		30.02		43.69		38.70	33.20		40.77
MgO				13.74		16.68		15.17		15.37	19.53		17.64
K_2O				0.05		1.19		0.08		0.09	0.12		0.08
P_2O_5				0.07		0.01		0.16		0.11	0.07		0.10
Al_2O_3				9.34		8.97		10.57		8.12	8.89		7.89
Fe_2O_3				7.33		4.12		4.23		3.13	3.46		2.85
TiO_2				0.49		0.39		0.44		0.32	0.36		0.26

*Daily composite

Table 26-19. ASH AND ATTRITED ACCEPTOR, RUN 26B

RUNS 27A, 27B AND 27C

JUNE 27 TO AUGUST 12, 1975

CO_2 ACCEPTOR PROCESS GASIFICATION

PILOT PLANT

RAPID CITY, SOUTH DAKOTA

1 SUMMARY

This report covers the Rapid City Pilot Plant operations for Runs 27A (June 27-July 7, 1975), 27B (July 15-22, 1975) and 27C (July 25-August 12, 1975).

Plant startup for Run 27A was interrupted five times. After reaching process temperature at 0700 hours July 4, 1975, the plant operation continued until 1306 hours July 7, 1975. At this time an offsite electrical power failure resulted in defluidization of the gasifier and regenerator beds and the plugging of the acceptor lift line. Since integrated operation could not be reestablished, the plant was shut down for cleaning and repairs.

Fourteen hours after attaining process temperatures in Run 27B, the regenerator bed was slumped. Gas flow adjustments were being made in an attempt to attain an acceptable regenerator temperature profile and eliminate afterburning. Inadvertently, the velocity became too low, defluidizing the regenerator bed and plugging the acceptor lift line. The plant was then shut down.

Run 27C was the most successful of the three runs. This run demonstrated for the first time in the pilot plant that pure steam could be used to fluidize the gasifier boot acceptor. For more than 25 hours the gasifier was operated with the only inputs being calcined acceptor, dried lignite coal and superheated steam. Achievements also included 243 hours of integrated plant operation at process temperatures and 65 hours of operation with no air injection into the gasifier. Fuel char transfer was steady throughout this time.

A major process upset occurred when the plant boiler shut down. The loss of steam to the gasifier resulted in slumping the char bed. The gasifier inventory was dumped. The reactor was then refilled with char and operating conditions were reestablished. However, the fuel char transfer to the regenerator could not be controlled and the pilot plant was shut down. Subsequent inspection revealed that the char transfer control valve butterfly had broken free of the shaft.

2 TEST DATA

Run 27 data are presented graphically and/or tabularly at the end of this run report. These figures and tables include:

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3 SIGNIFICANT EVENTS AND OBSERVATIONS

3.1 HISTORY OF RUNS 27A, 27B AND 27C

3.1.1 Objectives

For these runs the objectives were:

(1) To achieve long-term, integrated plant operation, preferably for a 30-day period.

(2) To demonstrate plant operation using pure steam to fluidize the gasifier.

(3) To establish balance periods to study the effects of process variables such as the gasifier and the regenerator temperatures, acceptor makeup rate and gasifier inlet steam flow.

3.1.2 Accomplishments

Run 27A

(1) Operated plant in an integrated manner with both reactors at operating conditions.

(2) Completed the stage in startup at which lignite is fed to the gasifier and fresh active acceptor is used to change out the dead-burned dolomite inventory.

Run 27B

(1) Operated plant in an integrated manner and attained process conditions in both reactors.

(2) Accomplished startup step of feeding lignite coal to the gasifier.

Run 27C

(1) Operated plant in an integrated manner and attained process conditions in both reactors.

(2) Demonstrated that 100 percent steam could be used to fluidize the collected acceptor in the gasifier boot.

(3) Successfully controlled the level of intermediate fines in the gasifier char bed.

(4) Improved the reliability of the fuel char feed from the gasifier by controlling the differential pressure drop across the upper section of the fuel char standleg.

(5) Obtained a series of 11 solids and 11 liquid samples for which compositions and trace element analysis will be obtained.

3.1.3 Reasons for Termination

Run 27A

An electrical storm caused a series of four electric power failures which slumped the gasifier and the regenerator beds and plugged the acceptor lift line. Flow could not be regained in the lift line.

Run 27B

The defluidization of the regenerator bed while trying to attain an acceptable regenerator temperature profile resulted in plugging the acceptor lift line. Acceptor lift flow could not be reestablished.

Run 27C

The run was terminated when flow of fuel char from the gasifier to the regenerator could not be controlled. After an orderly shutdown, inspection of LCV-2002 revealed that the butterfly had broken loose from the shaft.

3.1.4 Mechanical Problems

Run 27A

(1) The gasifier quench tower inlet continued to plug. Inspection of the venturi showed a hard, layered buildup in the diverging section. The open area was essentially the diameter of the blade on the rod out. Betz 403, a dispersing agent, and Betz 429, a surfactant, were injected into the makeup water but did not reduce the solids buildup.

(2) The auxiliary fuel char feed was out of service for approximately two and one-half hours due to a plug upstream of the feeder.

(3) Two minor hot spots on the calcined acceptor standleg (CD-206) and one on the acceptor lift line (CD-208) developed due to insulation voids.

(4) The withdrawal pipe to the S-10 sample station (recarbonated acceptor) broke at the weld to the recarbonated acceptor standleg liner (CD-204).

(5) Inspection of the expansion joints on the acceptor lift line (CD-208) revealed appreciable erosion in the lower two inches of the third floor cone. The hard surfacing and part of the cone itself had been eroded. The liner itself was eroded about thirteen inches above the sixth floor cone with a general thinning of the liner extending about three feet.

Run 27B

(1) During startup the gasifier recycle compressor, J-201B, was repaired.

(2) A char roller mill plug and air leaks in the lignite cyclone lift line caused the baghouse filter bags and hoses to be damaged.

(3) During cleanup after shutdown, a broken weld in the regenerator air ring was discovered.

Run 27C

(1) During startup an electrical malfunction in the emergency shutdown system caused XCV-2041 (regenerator lift gas to B-205 heater), LCV-2003 (acceptor transfer from the gasifier) and XCV-2013 (gasifier ring flow) to close.

(2) An electrical power dip caused all the recycle compressors to shut down. Activation of the control circuit installed previous to Run 27B prevented plugging of the acceptor lift line and all flows were returned to normal within a few minutes.

(3) The butterfly on the char transfer valve (LCV-2002) broke loose from the shaft and the shaft was slightly twisted.

(4) Two eroded holes through the inner liner of the acceptor lift line (CD-208) were discovered above the third floor expansion joint.

(5) Solids buildup in the gasifier quench venturi was less than in Run 27A but still present.

3.2 CHRONOLOGY OF OPERATIONS

3.2.1 Run 27A

Date	Time	Hours Run	Description
6/27	0900		Started pressuring the system with air.
"	1340		Plant depressured to repair leaks.
"	1630		Started pressuring up the system.
"	1918		Started static pressure test.
6/28	0045		Finished static pressure test. Started char lift gas compressor, J-309.
"	0200		Started all recycle compressors. Placed "A" and "B" gas dryers on line.
"	0315		Started gas circulation.
"	0345		Lit all heaters.
"	0600		Gasifier at 250°F, starting refractory cure.
"	1445		Experienced power failure.
"	1450		Power back and all compressors started and heaters relit.
"	1505		Experienced power dip.
			NOTE: All compressors and heaters shut down due to cycling problems with electrical power resulting from an electrical storm.
"	1530		Started L-207A, lignite feeder, test.
"	1555		Power back to normal, starting compressors and heaters.
"	1630		Started grinding lignite to preheater again.
"	1830		Attempted to send gas to methanation unit without success.
"	2230		Finished grinding lignite to the preheater.
6/29	0800		Finished J-207A feeder tests.
"	1000		Starting L-207B feeder tests. Finished refractory cure.
"	1300		Sending gas to the methanation unit.
			NOTE: Feed gas line to methanation unit is still partially plugged.
"	1545		Starting to cool the system down in preparation to depressuring. Could not send enough gas to methanation unit.
"	1845		Unit depressured.
"	2027		Pressuring up the system.
"	2105		Recycle compressors started.
"	2145		Starting to transfer gas to the methanation unit.
6/30	0215		Completed lignite feeder tests.
"	0900		Started dead-burned dolomite addition to the gasifier via F-204B, lignite feed lockhopper.

Date	Time	Hours Run	Description
6/30	1030		Having problems circulating through flow control valve, LCV-2003, (acceptor from gasifier).
"	1110		Dead-burned dolomite transferred to regenerator.
"	1550		Cooling system down. NOTE: Depressuring to check out LCV-2003, recarbonated acceptor control valve, and the recarbonated acceptor standleg.
7/1	0630		System depressured.
"	1215		Started pressuring system with air. NOTE: Found several pieces of fused material in the recarbonated acceptor standleg.
"	1315		Started static pressure test.
"	1400		Finished static pressure test.
"	1545		Recycle compressors started.
"	1600		Heaters lit.
7/2	0215		J-201B, gasifier recycle compressor, taken off line for maintenance.
"	0505		J-201B back on line.
"	0540		Started dead-burned dolomite to the gasifier via lignite lockhopper, F-204B.
"	0800		Started dolomite transfer to the regenerator.
"	0820		Started dead-burned dolomite addition to the regenerator via F-206, fresh dolomite lockhopper.
"	1550		Stopped dead-burned dolomite addition; regenerator full.
"	1610		Started acceptor circulation.
"	1700		Started reducing the outlet temperatures of the gasifier boot heater.
"	1915		Started dead-burned dolomite addition to bring the level of the regenerator back to the normal level after removing the air flow. NOTE: Having trouble with aeration gas to LCV-2003.
"	1930		Began grinding lignite to top off preheater.
"	2345		Started solids circulation tests. NOTE: Cleared out aeration gas line to LCV-2003.
7/3	0135		Solids circulation tests finished. Stopped acceptor circulation and started lift line gas flow tests.
"	0300		Finished lift line gas flow tests.
"	0330		Introduced steam to the gasifier side flow and reduced recycle gas flow.
"	0415		ZnO unit placed on line.
"	0420		Began feeding char to the gasifier via F-204A.

Date	Time	Hours Run	Description
7/3	0715		Introduced air into the gasifier side flow and removed the recycle gas flow.
"	0810		Experiencing problems in the gasifier boot and unable to transfer dolomite to the regenerator.
"	0900		Draining the contents of the gasifier to F-213, purged dolomite lockhopper. Stopped char and dolomite addition.
"	1400		Filling the gasifier boot with dead-burned dolomite again.
"	1430		Inert gas flow to the gasifier replaced with air to conserve N_2.
"	1500		Started solids circulation. NOTE: Circulation through LCV-2003 poor.
"	1830		Circulation through LCV-2003 improving. Removed air from the gasifier and replaced with inert gas.
"	1925		Started feeding char to the gasifier.
"	2040		Introduced air into the gasifier side flow.
"	2320		Introduced steam to the gasifier boot flow.
7/4	0220		Started feeding char to the regenerator via the auxiliary char system. Began drawing S-13A samples in order to establish fuel char transfer.
"	0315		Established fuel char transfer.
"	0700	0	Regenerator at 1800°F.
"	1410		Began feeding lignite to the system via F-204A.
"	2015		Found the lignite cyclone discharge feeder to the preheater not working.
7/5	0300		Feeder repaired, starting to grind lignite. NOTE: Having problems due to the overloading of the lignite scalping screen.
"	0735		Lost fuel char transfer.
"	0740		Lost auxiliary char feed, began burning methane in the regenerator.
"	0810		Stopped lignite feed to the gasifier.
"	1000	27	Started feeding char to the gasifier. Regained auxiliary char feed. NOTE: A plug developed above the auxiliary char feeder. This line was isolated from the system and the plug was blown into a tote bin by overpressuring F-226B.
"	1330		Fuel char transfer going very slowly.
"	1422		Started feeding lignite to the system.
"	1540		Fuel char transfer lining out. Auxiliary char feedback to minimum RPM.

Date	Time	Hours Run	Description
7/6	0600		Began 6 X 9 fresh dolomite addition to the system.
"	1010	53	Recycle gas flow to the regenerator air distributor discontinued.
"	1210		Began increasing gasifier boot steam.
"	1305	54.1	Power failure, closed all solids valves immediately.
"	1425		Began draining the gasifier of material. NOTE: Attempted to lift the regenerator bed, but the engager pot was plugged.
"	1615		Gasifier empty and attempting to clear the acceptor lift line without success. Started cooling the system down.
7/7	0455		System depressured.

3.2.2 Run 27B

7/15	2045		Started pressuring up the system with air.
"	2200		System up to pressure. Starting the static pressure tests.
"	2220		Finished the static pressure test. Started J-309, char lift line inert gas compressor.
"	2300		Started all recycle gas compressors. "A" gas dryer placed on line.
7/16	0110		Checking gas flow through LCV-2003 and XCV-2010. NOTE: Instrument technician worked on XCV-2010 because it was closing by itself. Valve malfunction was corrected.
"	0145		Heaters lit and began bringing the temperatures up at 100°F/HR.
"	0500		"B" gas dryer placed on line.
"	0720		Shut down J-201B, gasifier recycle gas compressor, for maintenance.
"	1000		J-201B back in service.
"	1025		Introduced air into the regenerator ring flow.
"	2115		Began adding dead-burned dolomite to the gasifier boot via F-204A, lignite feed lockhopper.
"	2130		Began grinding lignite to the preheater.
7/17	0035		Transferred some dead-burned dolomite to the regenerator from the gasifier via LCV-2003. Lost regenerator recycle gas flow through LCV-2032, recycle gas to the air ring. NOTE: Found a bad diaphragm in FRV-2032. Used the bypass until the valve was repaired.

Date	Time	Hours Run	Description
7/17	0130		Experiencing problems with the gasifier boot level instrumentation.
			NOTE: Overranged the FI's for the gasifier boot differential pressure recorder, dPR-2002, and the boot level began reading correctly.
"	0145		Started refilling the gasifier boot with dead-burned dolomite.
"	0300		Transferred dead-burned dolomite from the gasifier boot to the regenerator.
"	0305-0320		Started feeding dead-burned dolomite to the regenerator via L-204, fresh dolomite feeder.
			NOTE: Found a plug just above L-204 and feed was finally started at 0320 hours.
"	0945		Established dolomite circulation.
"	1045		Started the solids circulation tests.
			NOTE: Circulation very erratic and low.
"	1515		Initiated shutdown procedure in the 200 area in order to check out CD-206.
7/18	0530		System depressured.
"	1320		Started pressuring up the system.
			NOTE: Inspection of line CD-206 revealed the presence of some agglomerated solids.
"	1430		System up to pressure and starting the static pressure test.
"	1615		Finished the static pressure test. Started J-309 compressor.
"	1830		Started all recycle compressors.
"	1900		Heaters lit. "A" and "B" gas dryers placed on line.
"	2130		"B" gas dryer removed from service and placed on air to bring down the dew point.
			Started grinding lignite to the preheater.
7/19	0025		"B" gas dryer placed back on line.
"	0030		Introduced air into the regenerator ring.
"	0230		High differential pressure on the roller mill, stopped lignite feed.
"	0310		Baghouse temperature increasing rapidly.
"	0345		Baghouse temperature still high.
"	0720		Started filling the gasifier with dead-burned dolomite via F-204A.
"	0730		Roller mill cleaned out and cooling the grinding system down for maintenance.
			NOTE: Inspection of the baghouse after cooling down the 100 area showed that the bags were burned up.

Date	Time	Hours Run	Description
7/19	0930		Transferred a batch of dead-burned dolomite from the gasifier to the regenerator.
"	0935		Started feeding dead-burned dolomite to the regenerator via L-204.
"	1645		Initiated solids circulation.
"	1815		Started solids circulation tests.
"	2005		Finished solids circulation tests. Started gas circulation tests.
"	2100		Zinc oxide unit placed on line.
"	2200		Gas flow tests completed, reestablished solids circulation.
7/20	0110		Started reducing the air flow to the regenerator. Started reducing the temperature of the gasifier boot heaters.
"	0200		Introduced steam to the gasifier side.
"	0251		Started adding char to the gasifier via F-204A.
"	0720		Started air addition to the gasifier. NOTE: Adding char at minimum RPM until the 100 area is received back from maintenance.
"	1130		100 area repaired, starting to grind char. NOTE: Baghouse bags and hoses all replaced and various air leaks repaired.
"	1240		Introduced steam to the gasifier boot flow.
"	1915		Started char transfer to the regenerator.
"	1925		Started auxiliary char feed to the regenerator at minimum RPM.
"	2210		Finished grinding char, attempted to grind lignite. NOTE: Found the feeder below the lignite cyclone not operating.
"	2355	0	Regenerator at 1800°F.
"	2358		Cyclone feeder repaired and starting to grind lignite to the preheater.
7/21	0245		Experienced trouble with the lignite scalping screen and shut down the 100 area for maintenance.
"	0615		Began feedling lignite to the gasifier.
"	1230		Lost lignite feed to the gasifier.
"	1235		Lost fuel char transfer.
"	1236		Regained lignite feed.
"	1330		Fuel char transfer improving.
"	1605		Experiencing high exit gas temperature in the regenerator.
"	1615	16.3	Regenerator bed slumped. NOTE: During the high temperature period, the recycle gas was removed from the regenerator ring flow and the air was being reduced when the bed defluidized.

Date	Time	Hours Run	Description
7/21	1815		Began shutdown procedure. NOTE: Attempts to refluidize the regenerator failed due to the plugging of the acceptor lift line, CD-208.
"	2130		Started grinding lignite for the preheater in order to check the reliability of the 100 area.
7/22	0420		Unit depressured.

3.2.3 Run 27C

7/25	1050		Started grinding char to tote bins in the 100 area.
"	1200		Stopped grinding char. Started grinding lignite to the preheater.
"	1500		Started pressuring up the 200 area system with air.
"	1725		System up to pressure, started static pressure test.
"	1915		Finished grinding lignite and shut down 100 area grinding.
"	1920		Finished the static pressure test. Depressuring the system to repair a leak.
"	2055		Leak repaired and pressuring up the system.
"	2200		System up to pressure.
"	2210		Started J-309, char lift line gas compressor and all recycle gas compressors.
"	2300		"A" and "B" gas dryers placed on line.
"	2315		Lit all system heaters. NOTE: B-203, regenerator air heater, would not fire. Had to jumper high temperature shutdown to start the heater. Heater on at 0030 hours.
7/26	0100		Gasifier at 250°F, starting the refractory cure holding period.
"	0700		Finished temperature hold period and raising the system temperature at 50°F/HR.
"	1600		Gasifier at 700°F and starting the second hold period.
"	1645		Reduced steam to the preheater furnace, B-102, in order to relight it and slumped the fluidized bed.
"	2000		Finished second temperature hold period and raising the temperature at 100°F/HR.
"	2400		Preheater refluidized. NOTE: Had to dump two-thirds of the lignite in the preheater in order to refluidize the bed.

Date	Time	Hours Run	Description
7/27	0015		Started grinding char to tote bins.
"	0200		Started filling the gasifier boot with dead-burned dolomite via F-204A, lignite feed lockhopper.
"	0350		Transferred a batch of dead-burned dolomite to the regenerator from the gasifier.
"	0400		Started filling the regenerator with dead-burned dolomite via F-106, fresh dolomite feed lockhopper.
"	0700		Finished grinding char and started grinding lignite.
"	0745		Shut down the 100 area for maintenance. NOTE: Checked out the baghouse because of high differential pressure. Bags looked good.
"	1100		Initiated solids circulation.
"	1300		Started the solids circulation test.
"	1455		Finished the solids circulation test and stopped circulation. Started the lift line gas flow tests.
"	1500		Lift line flow tests finished. Re-established solids circulation. Placed the ZnO towers on line. Started lowering the gasifier boot heater temperatures. Started removing air from the gasifier. Began gas flow tests through the Elliott test turbine.
"	1915		Initiated steam to the gasifier side flow.
"	1920		Started feeding char to the gasifier via F-204A.
"	2225		Started air addition to the gasifier side flow.
7/28	0015		Started air addition to the regenerator ring flow. Started reducing the regenerator heater temperatures.
"	0335		Began steam addition to the gasifier boot flow. Started increasing the gasifier boot heater temperatures.
"	0425		Initiated fuel char transfer.
"	0435		Initiated auxiliary char feed. NOTE: Had to increase auxiliary char feed immediately because of problems with the char transfer line.
"	0630		Char transfer and char removal system smoothing out. The char transfer control valve lost air signal, signal returned after 5 minutes. Instrument technician checking it out. Electrical malfunction in control room panel caused emergency

Date	Time	Hours Run	Description
7/28	0630		valves controlling flows to regenerator lift heater (EHS-2041), acceptor transfer from gasifier (EHS-2003) and gasifier side flow (EHS-2013) to close. The engager pot became plugged due to the loss of lift line gas. Initiated shutdown procedures.
7/29	0350		System depressured.
"	0940-1105		Ran a series of lift line gas flow tests to be positive the lift line is clear.
"	1600		Started pressuring up the system with air.
"	1655		System up to pressure, started the static pressure tests.
"	1830		Began grinding lignite for the preheater.
"	1920		Finished the static pressure tests.
"	1930		Began recording the pressure drops across the heaters.
"	2200		Finished recording the heater pressure drops. Stopped grinding lignite due to a high baghouse dP. Lit the process heaters.
7/30	0015		Baghouse dP back down, started grinding lignite again.
"	0530		Stopped grinding lignite due to an overloaded scalping screen.
"	1000		Started dead-burned dolomite addition to the gasifier via F-204A
"	1115		Started grinding lignite for the preheater
"	1130		Transferred a batch of dead-burned dolomite to the regenerator from the gasifier.
"	1137		Started dead-burned dolomite to the regenerator via F-206.
"	1145		Experiencing trouble with the lignite dryer furnace.
"	1455		Stopped the dead-burned dolomite addition to the regenerator in order to repair F-206A, low level alarm.
"	1540		Resumed dead-burned dolomite addition to the regenerator.
"	2025		Initiated dead-burned dolomite circulation.
"	2130		Started the solids circulation tests.
"	2140		Circulation tests finished. Placed ZnO on line.
"	2220		Initiated steam addition to the gasifier side flow.
"	2255		Started char addition to the gasifier via F-204A. NOTE: Lost interface immediately due to a high boot flow. Reduced the flow and allowed the bed to strip the char.

Date	Time	Hours Run	Description
7/31	0210		Introduced air to the gasifier side flow.
"	0500		Started steam addition to the gasifier boot flow. Started increasing the gasifier boot heater temperature.
"	0832		Started fuel char transfer to the regenerator.
"	1100	0	Regenerator at 1800°F.
"	1522		Experienced a power dip; however, it was not long enough to cause any problems.
"	1835		Initiated lignite feed to the gasifier.
8/1	0800		Lost auxiliary char due to the inability to fill auxiliary char lockhopper, F-226B.
"	1300	26	Started feeding fresh 6 X 9 dolomite to the system.
"	1315		Experienced trouble getting L-207A, lignite feeder, to operate.
"	1347		Auxiliary char back on line.
"	1529		Had to stop lignite grinding due to high baghouse dP.
"	1610		Started grinding lignite again.
"	2000		Began removing air from the gasifier.
"	2045		Lost lignite feed and experienced a pressure bounce in the gasifier which caused the loss of the fuel char transfer. NOTE: Auxiliary char feed did not work, had to put methane into the regenerator for a short time.
"	2100		Situation slowly improving.
"	2245		System back on line.
8/2	0130		Grinding lignite again.
"	0820-2000		Found the tachometer on F-207A is not working correctly, electrician cannot fix it. Experienced continuous trouble with the auxiliary char feed. Also having trouble with high pressure drops across the lignite baghouse. Frequent shutdowns in grinding are required in order to allow the bags to clean themselves up.
"	2030	57.5	Air entirely out of the gasifier side flow.
"	2300		Slowly reducing the auxiliary char feed to to minimum RPM.
8/3	0215		Increasing acceptor circulation.
"	0230		Small pressure upset occurred while rodding out the gasifier venturi.
"	0500		Increasing the auxiliary char because valve LCV-2002 (char to regenerator) is fully open.

Date	Time	Hours Run	Description
8/3	0530		Experienced another pressure bounce when the gasifier venturi momentarily plugged.
"	1410		F-206A taken out of service for maintenance.
"	1430	75.5	F-204A taken out of service for maintenance.
"	1445		F-206A back on line. NOTE: Maintenance worked on the low level alarm.
"	1507		F-204A back in service. NOTE: Replaced the ball and seat on XCV-2089.
8/4	1135		Increased the recycle flow to the gasifier boot.
"	1312		Experienced a high char bed density in the gasifier bed. Reduced the circulation rate in order to decrease the density.
"	1345		Introduced air into the gasifier side flow.
"	1355		Cannot raise or lower the RPM's on L-207A (lignite feeder).
"	1508		Finished grinding lignite.
"	1600	101	L-207A repaired by maintenance.
"	1730		Decreased the gasifier boot flow, increased the char withdrawal rate, and decreased acceptor circulation to reduce char bed density in the gasifier.
"	1740		Gasifier bed density decreasing.
"	2020		Started grinding char to tote bins.
"	2030		Gasifier bed density at 37 LBS/CU FT, decreased the char withdrawal rate.
"	2100		Lost 6 X 9 dolomite makeup to the system. NOTE: The low level alarm on F-206A did not work.
8/5	0015		LCV-2002 (Fuel char to regenerator) air loading indicated that the valve was closed; however, no reduction of char flow.
"	0115		Stopped the auxiliary char feed and was able to control the regenerator CO and temperature with LCV-2002.
"	0140		Auxiliary char feedback on at minimum RPM.
"	0625		Increased acceptor circulation slightly.
"	0750		Fluidizing the preheater totally with steam. Preheater furnace air compressor shut down for maintenance.
"	1238		Increased char withdrawal slightly.
"	1405		Placed the preheater furnace back on line.

Date	Time	Hours Run	Description
8/5	1600	125	The spent acceptor dump hopper, F-213, has plugged off several times during the day. Cleared it each time by depressuring F-213 to 100 PSIG and then quickly opening the valve.
"	1800		Reduced char removal rate slightly.
8/6	0310		Experienced trouble with F-207A feeder. Bypassed the automatic controls, ran the feeder in hand position.
"	0430		F-207A feeder now working in automatic position.
"	0830	141	LCV-3010, gasifier quench tower level control valve, repaired by maintenance.
"	1010		Reduced char withdrawal rate.
"	1308		Upset the gasifier boot while placing "A" ZnO tower on line. Valved the tower out of service again.
8/7	0920		Fuel char transfer unstable. NOTE: Blocked F-226A from the system and char transfer lined out.
"	1130	168.5	Started reducing the amount of air to the gasifier side flow. Increasing auxiliary char feed and decreasing lignite feed.
"	1915		Decreased auxiliary char feed in order to have LCV-2002 on control.
"	2400		Lost fuel char transfer suddenly without apparent cause. Increased auxiliary char feed.
8/8	0100		Regained fuel char transfer, reduced auxiliary char feed.
"	0630		Stopped grinding lignite in order to clean the baghouse. NOTE: Attempted to start grinding again and found that the lignite cyclone, L-109-L5, rupture disc was blown.
"	0925		Repaired the rupture disc and grinding again.
"	1030	191.5	Line to F-213 plugged several times. Over-pressured F-213 in order to break the restriction.
8/9	0830		Hot spot found on the acceptor lift line on the third floor.
"	1045		Introduced CO_2 to the gasifier boot flow. Started increasing steam to the gasifier boot flow and reducing recycle gas.
"	1305		All recycle out of the gasifier boot, 100 percent steam. Started decreasing air flow to the gasifier.

Date	Time	Hours Run	Description
8/9	1400	219	Air injection to gasifier stopped.
"	1725		Lost auxiliary char feed for approximately 5 minutes.
"	2300		Lost auxiliary char feed again for 10 minutes.
8/10	0130		Lost auxiliary char feed again. NOTE: Increased purge below the feeder and the char flow stabilized.
"	0515		Major upset occurred when the gasifier quench tower level controller stuck open and the water level became low.
"	0555		Plant operation stabilizing after upset.
"	0625		Lost lignite feed for a short period when the feeder stopped. Feeder stopped for 4 minutes.
"	0700-1000		Worked on the gasifier quench tower level controller. System operation back to normal. Increased acceptor circulation slightly in order to raise the gasifier bed temperature.
"	1410	243.2	Boiler shut down, lost steam flow to the gasifier. Immediately started recycle gas to the gasifier, however, the bed defluidized. Loss of preheater steam was partially compensated for by increasing the load on the preheater furnace. The bed slumped but was refluidized when steam became available.
"	1500		Started dumping the gasifier contents to F-213.
"	2100		Gasifier empty, placed "A" ZnO tower on line. Increased air to the regenerator.
"	2105		Introduced 1,000 pounds of dead-burned dolomite to the gasifier boot.
"	2125		Initiated acceptor circulation.
"	2320		Started acceptor circulation tests.
"	2400		Finished circulation tests. Stopped acceptor circulation.
8/11	0340		Started acceptor circulation. Introduced steam to the gasifier side flow.
"	0350		Stopped solids circulation.
"	0410		Started solids circulation. Started adding char to the gasifier.
"	0420		Stopped solids circulation in order to establish the interface.

Date	Time	Hours Run	Description
8/11	0600		Interface established, started acceptor circulation.
"	0725		Started air flow to the gasifier side flow.
"	0745		Started dolomite makeup to the regenerator.
"	0940		Placed the char removal system on line.
"	1140		Started fuel char transfer, started auxiliary char at minimum RPM.
"	1215		Lost fuel char transfer.
"	1300		Stopped acceptor makeup.
"	1600		Started acceptor makeup.
"	1650		Shut LCV-2002, but solids flow through the valve continued. Lost the seal on the valve and emptied the line. Cut air to the regenerator and reduced acceptor circulation.
"	1815		Initiated shutdown procedure.
8/12	0550		Unit depressured.

4 RESULTS AND DISCUSSION

4.1 BACKGROUND

The primary objectives of the Run 27 series were to obtain heat and material balance data with 100 percent steam flow to the gasifier and for a 30 day run.

Runs 27A and 27B were interrupted early in the startup. Seven hours after initiating fresh acceptor feed in Run 27A, an off-site electrical power interruption defluidized the gasifier and regenerator beds and plugged the acceptor lift line. The run was terminated when the acceptor lift line could not be cleared after power was restored. Run 27B was also terminated early in the startup due to defluidization of the regenerator bed and plugging of the acceptor lift line. Regenerator recycle gas flow adjustments were being made at the time in an attempt to attain a more acceptable regenerator temperature profile. Since the acceptor lift line could not be cleared, the run was ended.

Although none of the runs in the Run 27 series achieved the stated objectives, Run 27C was the most successful. Prior to the run some recycle gas had always been fed to the gasifier boot to insure that acceptor agglomeration due to the formation of $CaCO_3$, CaO melts would not occur. Run 27C clearly demonstrated that this was unnecessary and that for the normal operating temperatures and pressures of the CO_2 Acceptor Process pure steam could be used to fluidize both the gasifier char bed and the collected acceptor in the gasifier boot. During the run, plant operation was stable for ten days. However, small variations in the steam boiler pressure caused fluctuations in the gasifier boot flow. While attempts were being made to stabilize the plant boiler controls to eliminate a 5 PSI pressure swing, the boiler shut down. When an acceptable char-acceptor interface could not be regained, the gasifier inventory was dumped. A char bed was then reestablished in the gasifier. Char combustion was restarted in the regenerator. However, fuel char transfer could not be reliably controlled. The decision was then made to proceed with an orderly shutdown. The following inspection revealed that the control valve butterfly had separated from the shaft.

After Run 26 and before Run 27C, no major changes were made to the process. Several minor changes were made, however.

In order to establish greater reliability in the control of the acceptor-char interface in the gasifier boot, two modifications were made. As shown in Figure 27-1(a), the original control scheme is sensitive to three purge taps. If any one of the three becomes plugged, the automatic control fails. In addition, the level of the interface becomes unknown. Currently, (Figure 27-1(b)) the control is sensitive

to only two purge taps. In addition, the installation of two more transmitter recorders, dPT-2011 and dPT-2112, over the boot region permit a check on purge tap plugging and, more importantly, permit manual interface control in the event of a tap plug.

The control circuit on valves XCV-2010 (regenerator lift line), LCV-2003 (acceptor transfer from gasifier), LCV-2002 (char transfer), and TCV-2030 (acceptor transfer from regenerator), and L-204 (makeup acceptor feeder) was modified to close the valves and stop the feeder in the event of a power interruption lasting longer than two seconds. Additionally, this can be done manually via a switch in the control room. This closed condition continued until manually overridden. Thus, in the event of a power interruption, these valves will remain closed and the feeder off until gas flows have been reestablished. The engager pots and lift lines will not plug with solids since XCV-2010, LCV-2002 and LCV-2003 will be closed. Closing TCV-2030 will maintain the seal between the regenerator and the gasifier and will also prevent acceptor from accumulating in the gasifier char bed.

4.2 ACCOMPLISHMENTS

4.2.1 Major Operational Achievements

The plant operation for Run 27 is summarized below:

Run	Process Conditions	Lignite Feed	Continuous Acceptor Circulation	Fresh Acceptor Makeup	Without Gasifier Air	Without Gasifier Recycle
27A	50	44	66	7	-	-
27B	16	8	38	-	-	-
27C	243	236	256	217	65	25

As this summary shows, Run 27C was very successful. Over ten days at process conditions were achieved with 65 hours without air and 25 hours with 100 percent steam to the gasifier. No adverse effects were observed by operating with only steam to the gasifier. The heating value of the synthesis gas produced during this period was 358 BTU/SCF.

4.2.2 Plant Data

Tables 27-1 through 27-6 summarize the plant data for each of the three runs. Process operating conditions are shown in Tables 27-1 through 27-6. Analyses of typical feedstocks are presented in Table 27-7, while analyses of circulated, purged and effluent solids are presented in Tables 27-8 through 27-24. Table 27-25 contains the pressure balance data for Run 27C.

Trace element analyses and heat and material balances for Run 27C will be issued separately.

4.2.3 Gasifier Char Bed

A new char sample tap was installed in the middle of the gasifier transition section. During Run 27C samples were collected routinely from this tap and the standard tap 12-3/4 feet higher in the gasifier bed. The percent char and the percent -20 mesh acceptor for these samples are plotted in Figures 27-2 and 27-3. These figures show no significant difference between the compositions. The comparison demonstrates that the gasifier char bed is relatively homogeneous.

4.2.4 Problems

(1) Gasifier quench. The gasifier quench continued to be a source of problems. Continuous rodding (manual removal of solids buildup) was necessary during all of the runs to maintain a low pressure drop across the venturi at the quench tower inlet. The addition of Betz 403, a dispersing agent, and Betz 429, a surfactant, reduced the hardness of the deposits but did not prevent the solids buildup.

Run 27C exhibited a considerable improvement over earlier runs. For example, during Run 27A the venturi was essentially plugged off with large deposits downstream of the throat. Water had been injected only at the throat. However, in Run 27C water was also injected in the diverging section. This addition kept the downstream piping cleaner.

(2) Acceptor lift line. The hard Stellite surfacing of the acceptor lift line cones showed extensive wear after both Runs 27A and 27C. In both cases the Stellite was worn away and the base metal had been eroded. Also during Run 27C, slight misalignment of the lift line eroded holes above one of the cones. This section of line had been service less than 16 days before wearing through. After Run 27C the cones were encased in 2 inches of Resco AA-22, a castable refractory. The refractory encasement was used as a possible means of providing an erosion resistant backing to the slip joints.

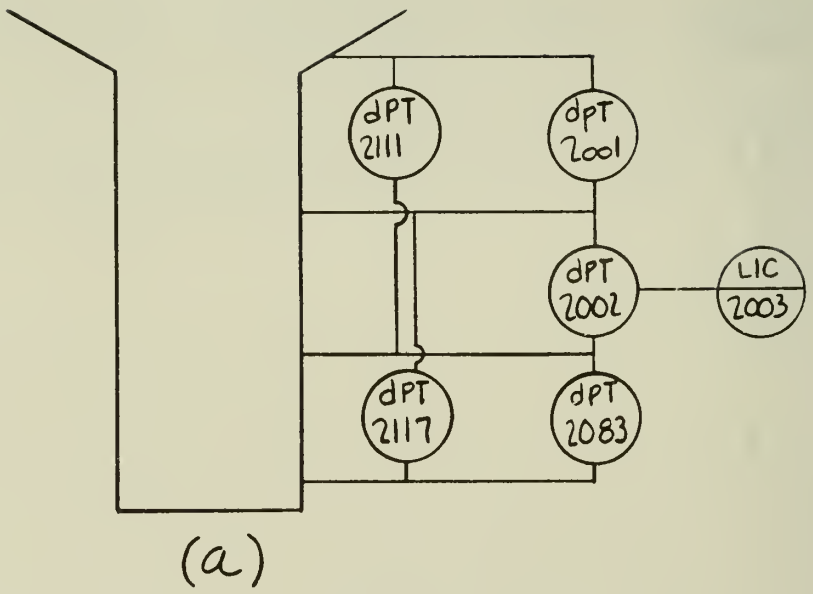
(3) Gasifier boot. Since its use as a startup material was initiated in Run 16, dead-burned dolomite deposits have periodically formed in the gasifier boot. While the bubble cap distributor installed after Run 22B reduced the severity of the problem, it did not eliminate it. Maintaining a high boot flow along with uniform gas distribution appears to have solved the problem.

During Runs 27B and 27C, the gasifier boot remained clean. Examination of the boot at shutdown showed only loose material. These runs were characterized by the use of high boot flows.

(4) Intermediate fines. The ability to control the buildup of intermediate fines (refer to Runs 22A, 22B, 22C and 23 report) via the char removal system was confirmed during Run 27C. As shown in Figure 27-4, the total pounds of this material remained relatively constant. In addition, the technique of controlling the differential pressure across the upper portion of the fuel char standleg permitted continuous fuel char feed.

5 FUTURE PLANS

The objectives for Run 28 are similar to those of Run 27. The primary objective will be a long steady-state balance period with no air and no recycle flow to the gasifier. The solid feeds will consist of Minnekahta limestone quarried in Rapid City and Velva lignite.



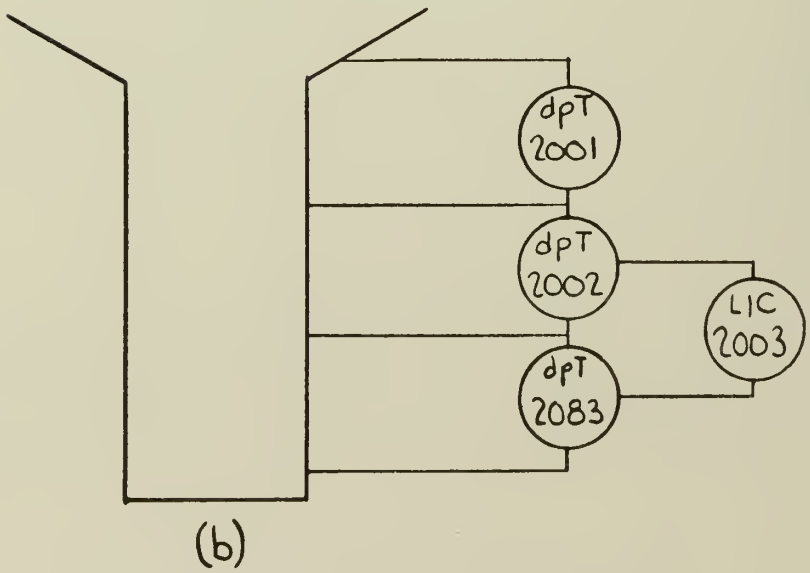


Figure 27-1. SCHEMATIC OF GASIFIER BOOT △P INSTRUMENTATION

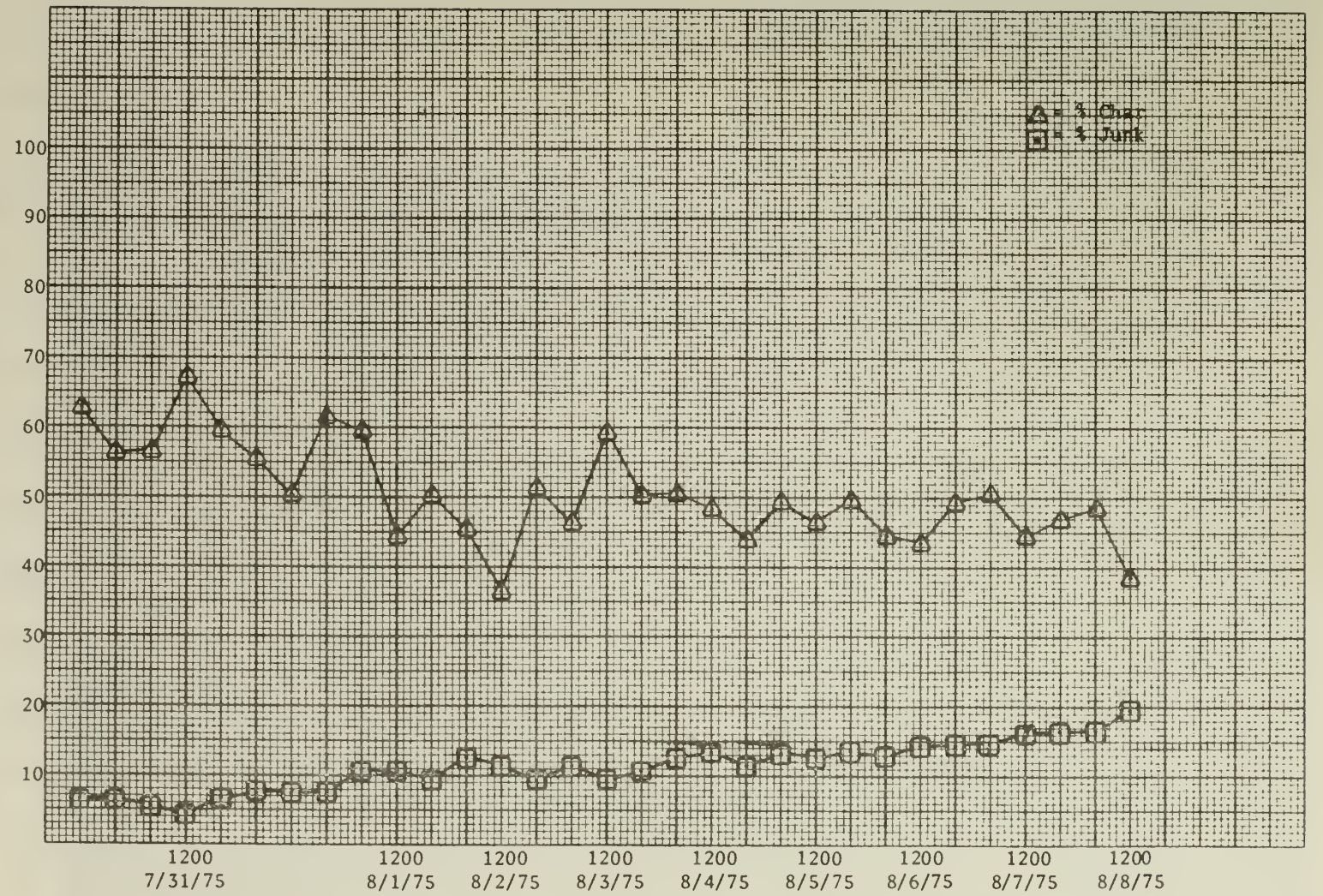


Figure 27-2. SAMPLE S-13B, RUN 27C

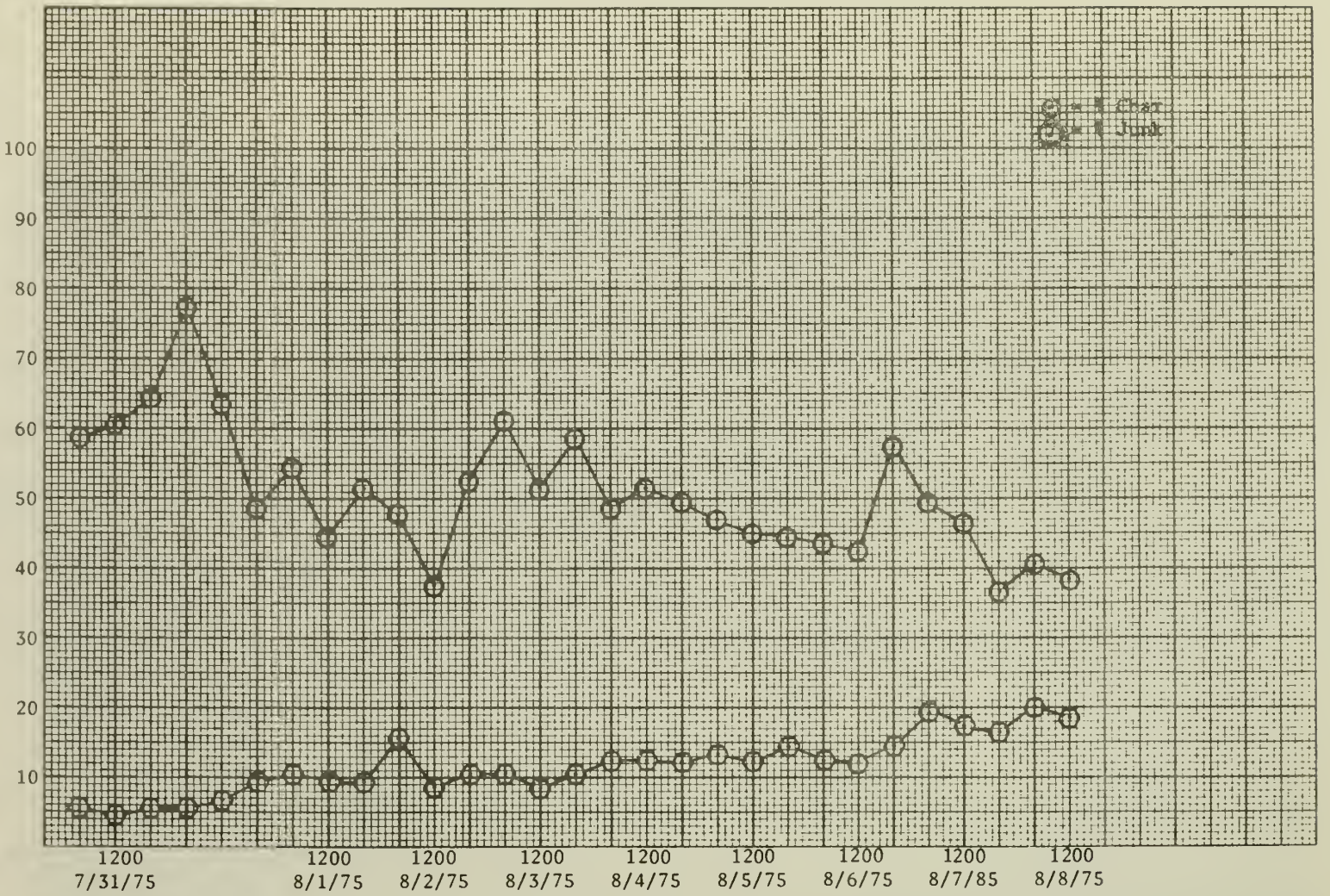


Figure 27-3. SAMPLE S-13C, RUN 27C

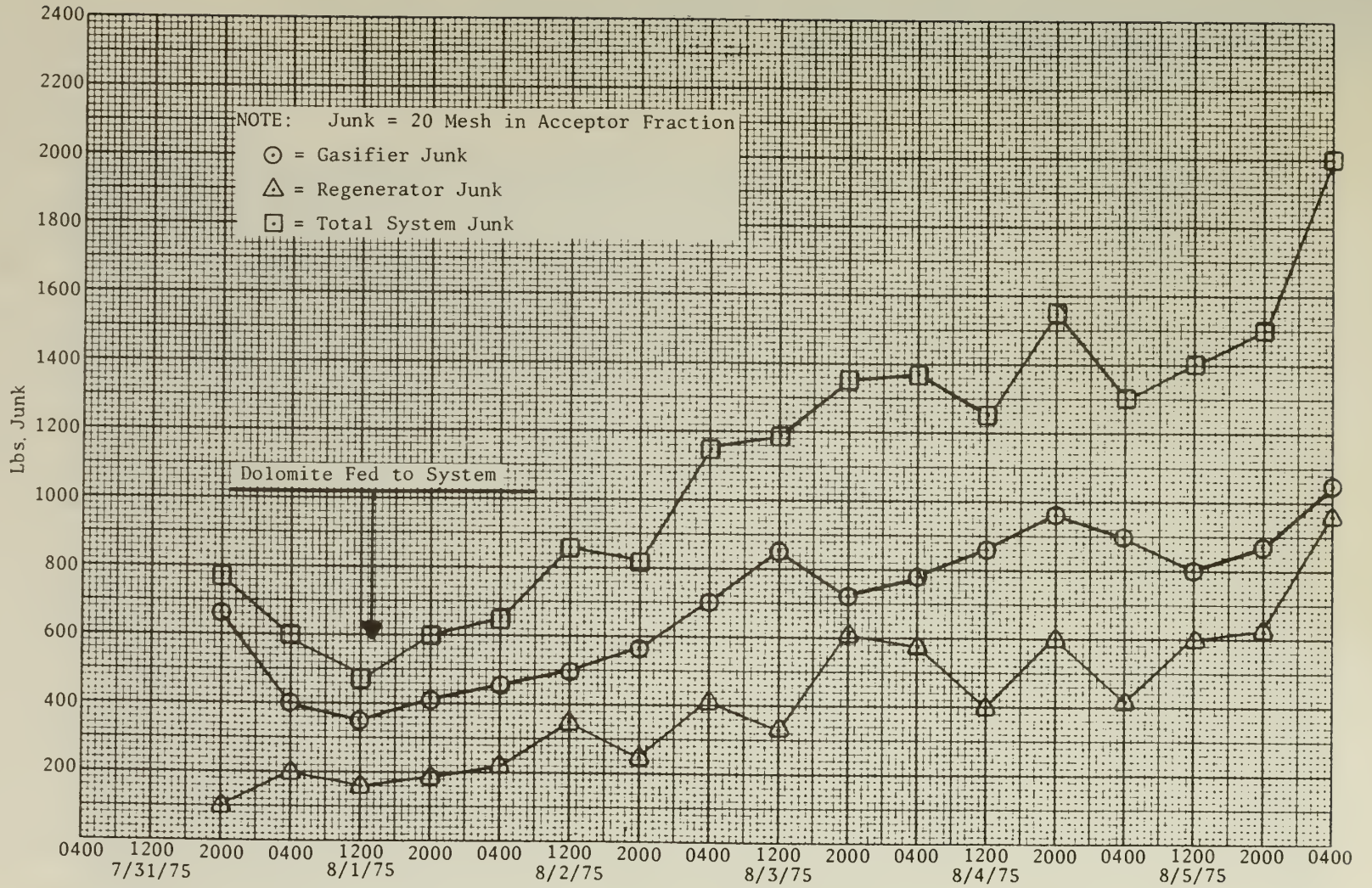


Figure 27-4. SYSTEM JUNK INVENTORY, RUN 27C (Sheet 1 of 2)

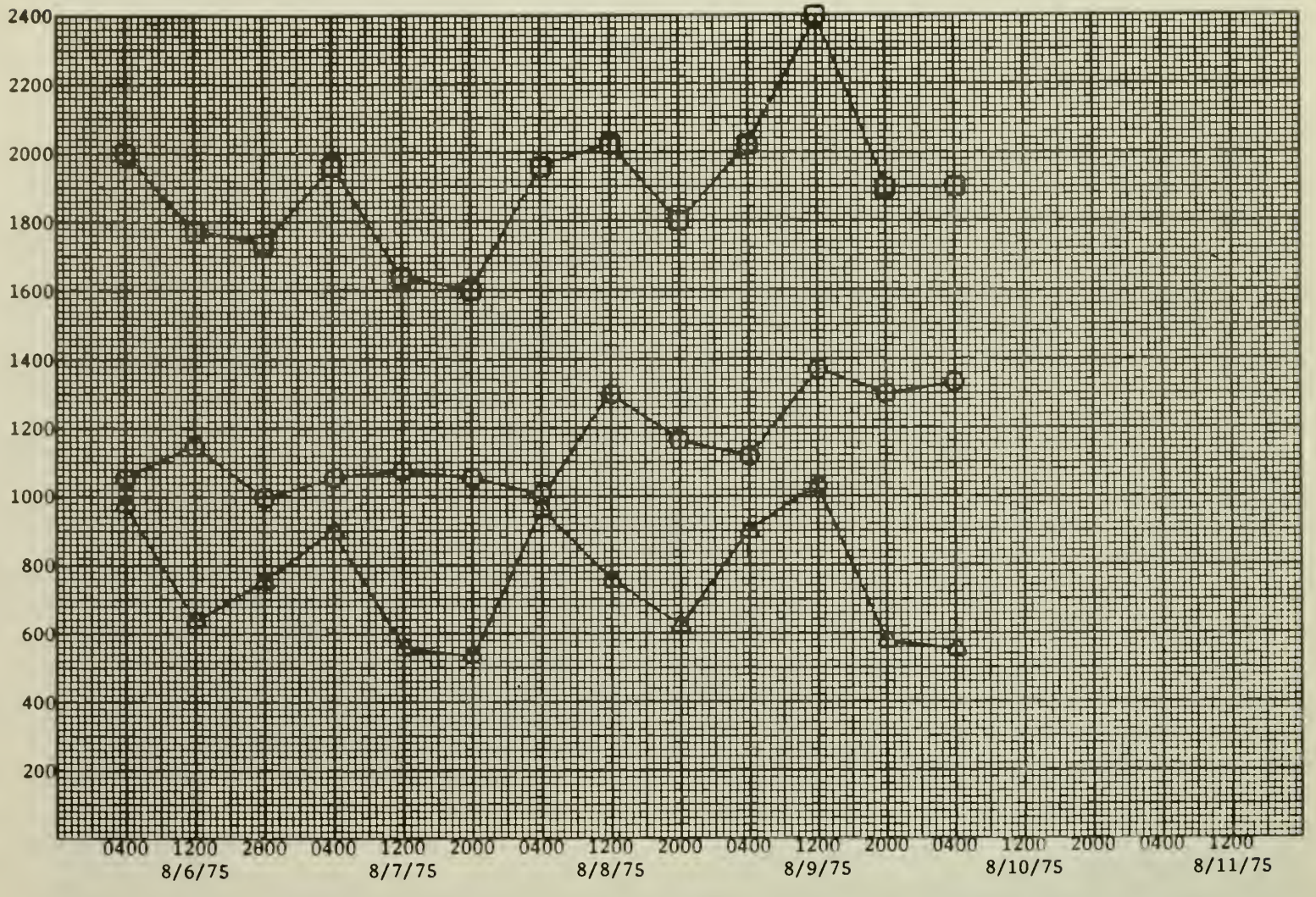


Figure 27-4. SYSTEM JUNK INVENTORY, RUN 27C (Sheet 2 of 2)

Date	← 7/04 →			← 7/05 →			← 7/6 →	
Time	1100	1500	2300	0700	1500	2300	0700	1100
Jacket Steam Make, lb/hr	30	30	31	31	31	31	31	31
Solids								
Feedstock	Char	← Velva Lignite →		Char	← Velva Lignite →			
Feed Rate, lb/hr(1)	1,040	1,780	1,710	2,120	2,120	2,120	2,088	2,088
Char Dump, lb/hr	139	106	182	129	337	165	153	129
Dump Acceptor, lb/hr	580	485	485	430	300	530	440	440
Gasifier Overhead Solids, lb/hr	22	45	108	67	75	68	94	52
Gas Flows(2)								
Boot (Recycle), SCFH	27,070	26,860	25,900	25,580	25,790	25,320	24,000	26,050
Boot (Steam), SCFH	20,340	20,250	21,440	20,360	20,330	20,960	21,020	20,930
CO_2 to Boot, SCFH	0	0	0	0	0	0	0	0
Steam to Side, SCFH	31,800	30,990	32,430	31,840	32,470	31,880	31,630	31,160
Air to Side, SCFH	19,660	19,970	20,110	20,290	19,790	19,940	20,110	20,400
Purges								
Recycle, SCFH	4,090	4,170	4,160	4,030	4,310	4,220	4,310	4,500
Inert, SCFH	230	230	230	230	230	230	230	230
Total Flow In, SCFH	103,190	102,470	104,270	102,330	102,920	102,550	101,300	103,270
Vent Rate, SCFH	55,830	58,260	69,310	69,290	62,560	76,790	74,310	77,910
Bed Conditions								
Boot Velocity, ft/sec	2.17	2.19	2.29	2.25	2.25	2.25	2.21	2.29
Char Bed Velocity, Inlet, ft/sec	0.98	0.98	1.02	1.01	1.01	1.00	1.00	1.02
Boot Density, lb/ft^3(3)	102	102	99	101	99	99	99	95
Char Bed Density, lb/ft^3(3)	42	38	34	35	38	36	32	35
Boot Temperature, °F	1467	1481	1491	1483	1471	1476	1473	1506
Char Bed Temperature, °F	1464	1474	1488	1481	1469	1473	1476	1505
Overhead Gas Composition, Mol %								
CO	14.5	16.2	18.3	18.5	16.0	17.7	18.2	20.1
CO_2	20.5	19.3	20.0	18.8	20.9	18.5	17.3	11.0
N_2	27.0	23.2	20.3	20.5	21.8	19.9	21.7	22.9
H_2	34.2	35.0	35.5	35.6	34.1	36.6	35.8	37.7
CH_4	3.8	6.3	5.9	6.6	7.1	7.3	7.0	8.3
H_2O Mol Fraction(4)	31.5	28.8	27.9	26.23	29.95	27.01	24.88	17.52

(1)
(2) Determined by feeder rpm - rpm·425
(3) Determined by orifice flow meter measurements
(4) Determined by differential pressure measurements
Calculated by water gas shift equilibrium

Table 27-1. GASIFIER DATA, RUN 27A

Date	7/4			7/5			7/6	
Time	1100	1500	2300	0700	1500	2300	0700	1100
Jacket Steam Make, lb/hr	300	200	230	310	310	210	210	205
Solids								
Acceptor Feedstock	Dead-Burned Dolomite						Tymochtee Dolomite	
Acceptor Makeup, lb/hr[1]	359	359	359	359	359	359	300	600
Acceptor Circulation, lb/hr[2]	5,540	7,340	12,120	13,590	12,680	14,230	13,290	14,290
Ash and Attrited Acceptor, lb/hr[3]	25	12	78	42	48	102	105	-
Auxiliary Fuel Char, lb/hr[1]	62	62	62	62	239	62	62	62
Gas Flows[4]								
Acceptor Lift, SCFH	53,560	53,680	53,600	53,690	53,540	53,660	53,500	52,940
Char Lift, SCFH	10,750	10,970	10,420	10,950	10,230	10,500	10,610	10,550
Air Line								
Recycle, SCFH	30,460	30,520	29,430	21,050	24,140	21,040	20,980	10,380
Air, SCFH	47,490	50,930	56,720	55,360	56,480	60,370	59,460	73,180
Purges								
Recycle, SCFH	1,820	1,820	1,820	1,810	1,820	1,820	1,810	1,790
Nitrogen, SCFH	2,030	2,290	2,230	2,230	2,560	2,560	2,560	2,450
Total Flow In, SCFH	146,110	150,210	154,220	145,090	148,770	149,950	148,920	151,290
Vent Rate, SCFH	55,490	60,980	64,800	67,660	80,870	74,520	71,070	88,270
Bed Conditions								
Gas Velocity, Inlet, ft/sec	2.66	2.72	2.79	2.62	2.72	2.72	2.70	2.74
Bed Density, lb/ft^3[5]	114	117	115	112	112	115	115	109
Average Bed Temperature, °F	1846	1839	1829	1829	1868	1846	1847	1836
Overhead Gas Analysis, Mol %								
O_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	0.44	4.04	2.51	1.15	1.47	3.44	2.60	2.60
CO_2	17.15	16.36	17.15	17.95	16.75	16.75	18.76	22.90
N_2	79.4	79.60	80.34	80.90	81.77	79.80	78.64	78.64

(1) Determined by feeder rpm - dead-burned dolomite, rpm·359; dolomite, rpm·300; auxiliary fuel, rpm·346
(2) Determined by lift line pressure drop measurements
(3) Determined by weigh scale measurements
(4) Determined by orifice flow meter measurements
(5) Density indicated by pressure tap readings

Table 27-2. REGENERATOR DATA, RUN 27A

Date	7/20	← 7/21 →	
Time	2300	0700	1500
Jacket Steam Make, lb/hr	0	0	0
Solids			
Feedstock	Char	Velva Lignite	
Feed Rate, lb/hr(1)	1,150	1,620	1,840
Char Dump, lb/hr	-	-	-
Dump Acceptor, lb/hr	-	-	-
Gasifier Overhead Solids, lb/hr	3	130	-
Gas Flows(2)			
Boot (Recycle), SCFH	26,410	25,360	22,800
Boot (Steam), SCFH	17,940	19,260	20,880
CO_2 to Boot, SCFH	0	0	0
Steam to Side, SCFH	30,220	30,190	30,750
Air to Side, SCFH	19,000	20,840	20,660
Purges			
Recycle, SCFH	4,240	4,410	4,300
Inert, SCFH	230	230	230
Total Flow In, SCFH	98,040	100,290	99,620
Vent Rate, SCFH	52,690	65,870	67,490
Bed Conditions			
Boot Velocity, ft/sec	2.18	2.21	2.23
Char Bed Velocity, Inlet, ft/sec	0.94	0.98	0.99
Boot Density, lb/ft^3(3)	108	108	106
Char Bed Density, lb/ft^3(3)	42	41	33
Boot Temperature, °F	1418	1488	1471
Char Bed Temperature, °F	1414	1478	1465
Overhead Gas Composition, Mol %			
CO	11.2	17.4	17.2
CO_2	11.7	13.6	18.6
N_2	35.6	27.9	22.8
H_2	31.5	35.0	34.7
CH_4	4.4	6.1	6.7
H_2O Mol Fraction(4)	29.6	21.1	26.3

(1)
(2) Determined by feeder rpm, rpm.425
(3) Determined by orifice flow meter measurements
(4) Determined by differential pressure measurements
Calculated by water gas shift equilibrium

Table 27-3. GASIFIER DATA, RUN 27B

Date	7/20	← 7/21 →	
Time	2300	0700	1500
Jacket Steam Make, lb/hr	0	0	0
Solids			
Acceptor Feedstock	Dead-Burned Dolomite		
Acceptor Makeup, lb/hr[1]	359	359	359
Acceptor Circulation, lb/hr[2]	3,520	10,840	12,100
Ash and Attrited Acceptor, lb/hr[3]	43	43	-
Auxiliary Fuel Char, lb/hr[1]	75	75	75
Gas Flows[4]			
Acceptor Lift, SCFH	59,350	55,970	55,250
Char Lift, SCFH	9,930	9,970	9,890
Air Line			
Recycle, SCFH	56,680	15,770	15,740
Air, SCFH	51,430	59,720	59,110
Purges			
Recycle, SCFH	1,810	1,810	1,820
Nitrogen, SCFH	2,390	2,330	2,970
Total Flow In, SCFH	181,590	145,570	144,780
Vent Rate, SCFH	61,750	63,700	65,370
Bed Conditions			
Gas Velocity, Inlet, ft/sec	3.13	2.65	2.60
Bed Density, lb/ft^3[5]	108	120	114
Average Bed Temperature, °F	1721	1856	1829
Overhead Gas Analysis, Mol %			
O_2	0.0	0.0	0.0
CO	4.14	3.16	0.14
CO_2	17.95	18.36	17.55
N_2	77.9	78.49	82.31

(1) Determined by feeder rpm - dead-burned, rpm·359; dolomite, rpm·300; auxiliary fuel, rpm·346
(2) Determined by lift line pressure drop measurements
(3) Determined by weigh scale measurements
(4) Determined by orifice flow meter measurements
(5) Density indicated by pressure tap readings

Table 27-4. REGENERATOR DATA, RUN 27B

Date	7/31		← 8/1 →			← 8/2 →			← 8/3 →		
Time	1500	2300	0700	1500	2300	0700	1500	2300	0700	1500	2300
Jacket Steam Make, lb/hr	0	0	0	0	0	0	0	0	0	0	0
Solids											
Feedstock	Char	←				Velva Lignite					→
Feed Rate, lb/hr(1)	1,080	1,800	1,260	1,080	1,800	2,520	2,300	1,260	2,230	2,160	2,160
Char Dump, lb/hr	230	180	120	150	100	150	120	90	130	150	70
Dump Acceptor, lb/hr	230	240	430	370	310	270	390	280	280	310	180
Gasifier Overhead Solids, lb/hr	50	10	210	50	110	0	30	40	230	30	40
Gas Flows(2)											
Boot (Recycle), SCFH	20,150	21,240	22,260	21,910	18,520	21,090	17,560	13,080	11,750	12,790	8,490
Boot (Steam), SCFH	23,160	20,650	22,590	22,180	24,850	25,240	29,540	35,790	35,630	35,680	36,560
CO_2 to Boot, SCFH	0	0	0	0	0	0	0	0	0	0	0
Steam to Side, SCFH	30,100	30,480	30,100	29,970	35,170	32,610	28,910	30,610	28,790	28,490	27,610
Air to Side, SCFH	19,540	20,280	20,000	19,940	23,640	17,920	12,340	0	0	0	0
Purges											
Recycle, SCFH	3,710	3,950	4,470	4,370	3,950	4,190	4,190	4,800	4,880	5,610	4,880
Inert, SCFH	230	230	230	230	230	230	230	230	230	230	230
Total Flow In, SCFH	96,890	96,830	99,650	98,600	106,360	101,280	92,770	84,510	81,280	82,800	77,770
Vent Rate, SCFH	60,640	68,500	67,430	70,580	64,905	77,430	66,830	41,060	37,700	56,810	49,830
Bed Conditions											
Boot Velocity, ft/sec	2.18	2.17	2.29	2.30	2.17	2.41	2.45	2.45	2.41	2.46	2.3
Char Bed Velocity, Inlet, ft/sec	0.96	0.98	0.99	0.99	1.04	1.03	0.93	0.81	0.79	0.80	0.76
Boot Density, lb/ft3(3)	104	104	102	99	95	93	89	84	84	83	83
Char Bed Density, lb/ft3(3)	44	38	33	33	33	34	35	28	36	37	37
Boot Temperature, °F	1450	1487	1470	1479	1424	1534	1530	1496	1482	1505	1484
Char Bed Temperature, °F	1453	1480	1464	1470	1419	1510	1503	1475	1475	1497	1481
Overhead Gas Composition, Mol %											
CO	21.9	17.8	16.6	16.4	10.7	17.3	16.3	12.0	13.3	13.6	13.1
CO_2	6.9	15.0	16.0	15.7	20.6	10.4	13.2	11.4	9.6	9.2	9.2
N_2	29.6	25.0	25.5	21.4	30.2	19.4	14.6	3.3	2.7	2.8	3.7
H_2	36.2	36.0	35.5	39.7	32.4	43.7	47.0	61.8	59.5	64.1	59.5
CH_4	5.4	6.2	6.4	6.7	6.1	9.2	7.6	11.5	14.9	10.3	14.5
H_2O Mol Fraction(4)	9.6	22.9	24.5	26.8	35.1	21.4	41.00	36.3	29.4	-	29.1

(1)
(2) Determined by feeder rpm - rpm·425
(3) Determined by orifice flow meter measurements
(4) Determined by differential pressure measurements
Calculated by water gas shift equilibrium

Table 27-5. GASIFIER DATA, RUN 27C (Sheet 1 of 3)

Date	8/4			8/5			8/6		
Time	0700	1500	2300	0700	1500	2300	0700	1500	2300
Jacket Steam Make, lb/hr	0	0	0	0	0	0	0	20	30
Solids	Velva Lignite								
Feedstock									
Feed Rate, lb/hr[1]	2,340	1,910	3,060	2,160	2,630	2,630	2,630	2,450	2,450
Char Dump, lb/hr	180	230	240	150	230	360	470	340	140
Dump Acceptor, lb/hr	150	330	280	240	180	140	320	360	360
Gasifier Overhead Solids, lb/hr	-	130	170	170	220	200	160	230	160
Gas Flows[2]									
Boot (Recycle), SCFH	8,650	9,430	6,090	7,590	6,200	6,120	6,160	5,020	4,920
Boot (Steam), SCFH	36,710	36,530	37,380	36,760	36,760	35,680	37,170	38,180	37,950
CO_2 to Boot, SCFH	0	0	0	0	0	0	0	0	0
Steam to Side, SCFH	28,750	28,150	26,790	28,110	27,430	27,470	27,650	27,100	27,130
Air to Side, SCFH	0	4,810	4,710	4,510	4,490	4,510	4,540	4,650	4,620
Purges									
Recycle, SCFH	4,970	4,870	4,650	4,880	4,810	4,910	5,180	4,860	4,780
Inert, SCFH	230	230	230	230	230	230	230	230	230
Total Flow In, SCFH	79,310	84,020	79,850	82,080	79,920	78,920	80,930	80,040	76,630
Vent Rate, SCFH	51,740	57,300	63,110	54,810	56,190	37,910	55,190	60,230	55,830
Bed Conditions									
Boot Velocity, ft/sec	2.32	2.37	2.28	2.26	2.18	2.13	2.20	2.21	2.20
Char Bed Velocity, Inlet, ft/sec	0.77	0.83	0.79	0.80	0.78	0.76	0.78	0.78	0.78
Boot Density, lb/ft^3[3]	83	83	81	81	81	81	81	80	78
Char Bed Density, lb/ft^3[3]	39	42	36	34	36	36	37	38	37
Boot Temperature, °F	1488	1501	1502	1502	1480	1477	1473	1493	1487
Char Bed Temperature, °F	1485	1500	1482	1492	1468	1468	1469	1482	1478
Overhead Gas Composition, Mol %									
CO	13.2	14.0	14.5	13.7	12.3	12.5	13.0	13.4	13.0
CO_2	9.2	7.5	11.3	9.8	10.6	10.5	10.4	9.8	10.7
N_2	2.7	9.5	6.5	7.6	8.4	9.5	8.9	7.1	8.5
H_2	61.3	56.2	54.9	57.2	55.7	54.7	54.5	57.2	55.2
CH_4	13.6	12.8	12.8	11.7	13.0	12.8	13.2	12.5	12.6
H_2O Mol Fraction[4]	29.7	23.5	29.6	29.1	31.5	30.6	29.5	29.2	30.7

(1) Determined by feeder rpm - rpm·425
(2) Determined by orifice flow meter measurements
(3) Determined by differential pressure measurements
(4) Calculated by water gas shift equilibrium

Table 27-5. GASIFIER DATA, RUN 27C (Sheet 2 of 3)

Date	8/7			8/8			8/9			8/10	
Time	0700	1500	2300	0700	1500	2300	0700	1500	2300	0700	1100
Jacket Steam Make, lb/hr	-	20	0	0	0	0	-	-	-	10	0
Solids	Velva Lignite										
Feedstock											
Feed Rate, lb/hr(1)	2,450	2,300	2,160	2,340	2,270	2,120	2,090	2,090	2,230	2,230	2,230
Char Dump, lb/hr	130	130	270	120	110	110	100	110	100	90	90
Dump Acceptor, lb/hr	360	330	510	180	510	510	240	170	280	160	160
Gasifier Overhead Solids, lb/hr	260	200	140	80	100	120	320	360	110	30	10
Gas Flows(2)											
Boot (Recycle), SCFH	6,200	9,390	10,710	9,160	6,340	6,980	6,860	0	0	0	0
Boot (Steam), SCFH	37,440	37,330	35,940	38,740	39,250	39,030	38,520	42,740	41,740	40,610	41,000
CO_2 to Boot, SCFH	0	0	0	0	0	0	0	330	320	300	310
Steam to Side, SCFH	27,170	27,430	27,910	27,100	26,380	26,420	27,130	26,600	27,020	25,670	27,580
Air to Side, SCFH	4,670	2,990	2,710	3,640	2,720	2,680	2,800	0	0	0	0
Purges											
Recycle, SCFH	4,840	4,900	4,960	5,220	4,980	5,070	4,940	4,820	4,920	4,870	4,740
Inert, SCFH	230	230	230	230	230	230	230	230	230	230	230
Total Flow In, SCFH	80,550	82,270	82,460	84 090	79,900	80,410	80,480	74,720	74,230	71,680	73,860
Vent Rate, SCFH	48,430	54,990	48,380	58,150	54,690	50,590	52,280	50,520	52,350	57,550	55,030
Bed Conditions											
Boot Velocity, ft/sec	2.21	2.21	2.30	2.26	2.16	2.08	2.01	1.96	2.03	2.02	2.06
Char Bed Velocity, Inlet, ft/sec	0.78	0.77	0.79	0.78	0.74	0.73	0.72	0.68	0.70	0.68	0.72
Boot Density, lb/ft^3(3)	78	78	78	77	77	77	75	75	77	75	75
Char Bed Density, lb/ft^3(3)	37	37	34	35	36	34	33	35	38	37	38
Boot Temperature, °F	1489	1495	1484	1486	1492	1470	1470	1484	1481	1479	1479
Char Bed Temperature, °F	1485	1485	1480	1485	1483	1468	1473	1494	1484	1486	1494
Overhead Gas Composition, Mol %											
CO	13.3	13.1	12.7	12.2	13.2	13.0	13.0	15.2	13.2	13.0	13.5
CO_2	10.4	9.9	10.1	10.2	11.2	9.2	9.5	12.9	13.9	14.0	10.8
N_2	7.7	7.1	8.0	7.1	6.1	9.3	8.9	3.0	2.5	3.0	4.1
H_2	55.8	57.2	56.6	58.9	56.9	56.1	56.2	59.0	58.0	57.6	59.4
CH_4	12.9	12.7	12.6	11.6	12.6	12.4	12.4	11.9	12.4	12.3	12.1
H_2O Mol Fraction(4)	30.1	30.0	30.6	-	32.3	27.6	28.4	33.5	37.7	38.1	32.4

(1)
(2) Determined by feeder rpm - rpm·425
(3) Determined by orifice flow meter measurements
(4) Determined by differential pressure measurements
Calculated by water gas shift equilibrium

Table 27-5. GASIFIER DATA, RUN 27C (Sheet 3 of 3)

Date	7/31		8/1			8/2			8/3		
Time	1500	2300	0700	1500	2300	0700	1500	2300	0700	1500	2300
Jacket Steam Make, lb/hr	200	320	210	220	220	210	230	230	220	230	220
Solids	Dead-Burned Dolomite			Tymochtee Dolomite							
Acceptor Feedstock	359	359	359	600	600	600	600	600	600	600	600
Acceptor Makeup lb/hr(1)	7,960	11,940	11,780	12,180	9,750	11,430	11,740	11,330	12,310	14,460	11,640
Acceptor Circulation, lb/hr(2)	120	90	200	190	520	400	380	290	230	220	230
Ash and Attrited Acceptor, lb/hr(3)	75	75	75	90	75	75	75	410	125	75	75
Auxiliary Fuel Char, lb/hr(1)											
Gas Flows(4)											
Acceptor Lift, SCFH	52,830	52,380	52,960	51,930	53,130	53,240	53,650	53,050	53,740	53,790	53,860
Char Lift, SCFH	9,940	10,020	9,960	9,930	8,050	10,310	10,260	10,100	9,980	10,130	10,110
Air Line											
Recycle, SCFH	32,200	31,690	31,740	24,330	52,890	10,010	9,990	0	2,000	0	0
Air, SCFH	50,790	55,060	57,100	62,370	60,230	73,340	75,340	78,170	82,680	81,830	80,510
Purges											
Recycle, SCFH	1,810	1,810	1,810	1,800	1,830	1,770	1,770	1,780	1,770	1,770	1,770
Nitrogen, SCFH	2,450	-	2,160	2,710	2,220	2,330	2,100	2,220	2,220	1,890	1,780
Total Flow In, SCFH	150,020	150,960	155,730	153,070	178,350	151,000	153,110	145,320	152,390	149,410	148,030
Vent Rate, SCFH	58,440	64,140	67,520	77,010	53,990	93,320	94,570	96,500	102,760	104,450	103,700
Bed Conditions											
Gas Velocity, Inlet, ft/sec	2.76	2.79	2.84	2.75	2.88	2.72	2.78	2.63	2.79	2.73	2.72
Bed Density, lb/ft3(5)	105	102	100	97	94	88	87	82	78	79	77
Average Bed Temperature, °F	1861	1847	1848	1826	1581	1829	1839	1834	1857	1855	1861
Overhead Gas Analysis, Wt %											
O_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	3.1	2.6	3.3	5.1	4.5	2.2	2.7	2.2	3.1	1.7	3.5
CO_2	18.0	18.8	18.8	21.2	15.6	27.6	26.8	26.3	27.6	27.2	27.6
N_2	79.0	78.4	78.0	73.7	80.0	70.2	70.6	71.5	69.3	71.1	68.8

(1) Determined by feeder rpm - dead-burned dolomite, rpm·359; dolomite, rpm·300; auxiliary fuel, rpm·346
(2) Determined by lift line pressure drop measurements
(3) Determined by weigh scale measurements
(4) Determined by orifice flow meter measurements
(5) Density indicated by pressure tap readings

Table 27-6. REGENERATOR DATA, RUN 27C (Sheet 1 of 3)

Date	8/4			8/5			8/6		
Time	0700	1500	2300	0700	1500	2300	0700	1500	2300
Jacket Steam Make, lb/hr	220	220	200	200	300	200	380	230	200
Solids									
Acceptor Feedstock	Tymochtee Dolomite								
Acceptor Makeup, lb/hr[1]	600	600	600	600	600	600	600	600	600
Acceptor Circulation, lb/hr[2]	11,300	9,760	10,380	10,070	10,970	10,690	9,750	11,330	11,330
Ash and Attrited Acceptor, lb/hr[3]	310	180	110	180	160	200	240	220	220
Auxiliary Fuel Char, lb/hr[1]	75	75	75	75	75	75	75	75	75
Gas Flows[4]									
Acceptor Lift, SCFH	53,700	54,090	53,550	53,590	53,450	53,530	53,140	53,510	53,820
Char Lift, SCFH	10,140	10,260	10,370	10,410	9,920	10,340	10,290	10,360	10,340
Air Line									
Recycle, SCFH	0	0	0	0	0	0	0	0	0
Air, SCFH	80,310	80,740	77,160	76,490	78,200	80,200	79,540	78,230	77,830
Purges									
Recycle, SCFH	1,760	1,770	1,760	1,760	1,760	1,760	1,760	1,760	1,770
Nitrogen, SCFH	1,490	1,420	1,630	1,270	1,360	1,320	1,270	1,360	1,420
Total Flow In, SCFH	147,400	148,280	144,470	143,520	144,690	147,150	146,000	145,220	145,180
Vent Rate, SCFH	100,170	105,740	105,440	96,950	103,340	102,610	103,590	100,690	99,660
Bed Conditions									
Gas Velocity, Inlet, ft/sec	2.67	2.69	2.63	2.64	2.65	2.69	2.68	2.65	2.64
Bed Density, lb/ft^3[5]	77	79	73	74	75	75	76	76	73
Average Bed Temperature, °F	1828	1826	1841	1862	1846	1845	1856	1839	1836
Overhead Gas Analysis, Wt %									
O_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	2.2	5.3	3.1	4.0	3.5	2.6	2.8	3.3	2.7
CO_2	29.4	27.2	29.9	29.9	29.4	29.4	29.9	29.0	27.2
N_2	68.5	67.5	67.1	66.1	67.1	68.0	67.4	67.8	70.1

(1) Determined by feeder rpm - dead-burned dolimite, rpm·359; dolomite, rpm·300; auxiliary fuel, rpm·346
(2) Determined by lift line pressure drop measurements
(3) Determined by weigh scale measurements
(4) Determined by orifice flow meter measurements
(5) Density indicated by pressure tap readings

Table 27-6. REGENERATOR DATA, RUN 27C (Sheet 2 of 3)

Date	8/7			8/8			8/9			8/10	
Time	0700	1500	2300	0700	1500	2300	0700	1500	2300	0700	1100
Jacket Steam Make, lb/hr	200	320	420	360	340	200	200	390	200	200	270
Solids											
Acceptor Feedstock	Tymochtee Dolomite										
Acceptor Makeup, lb/hr[1]	600	600	600	600	600	600	600	600	600	600.	600
Acceptor Circulation, lb/hr[2]	9,780	11,270	9,100	9,760	9,150	10,310	10,280	12,080	11,200	11,800	11,220
Ash and Attrited Acceptor lb/hr[3]	110	210	200	100	120	230	150	120	140	120	90
Auxiliary Fuel Char, lb/hr[1]	75	160	175	175	100	160	150	175	175	180	175
Gas Flows[4]											
Acceptor Lift, SCFH	53,610	53,520	54,140	53,850	53,760	53,760	53,730	53,560	53,560	53,590	53,530
Char Lift, SCFH	10,380	10,300	10,390	10,400	10,450	10,450	10,510	10,470	10,490	10,520	10,470
Air Line											
Recycle, SCFH	0	0	0	0	0	0	0	0	0	0	0
Air, SCFH	77,800	77,380	81,240	81,080	78,130	72,690	76,140	83,530	82,530	81,950	83,390
Purges											
Recycle, SCFH	1,760	1,770	1,780	1,770	1,770	1,770	1,760	1,770	1,770	1,760	1,760
Nitrogen, SCFH	1,380	1,590	1,450	1,450	1,270	1,320	1,320	1,270	1,190	1,190	1,320
Total Flow In, SCFH	144,930	144,560	149,000	148,550	145,380	139,990	143,460	150,600	149,540	149,010	150,470
Vent Rate, SCFH	98,950	99,500	105,320	103,930	99,810	93,740	93,660	105,790	103,840	103,360	103,710
Bed Conditions											
Gas Velocity, Inlet, ft/sec	2.67	2.65	2.71	2.71	2.68	2.54	2.60	2.76	2.74	2.71	2.78
Bed Density, lb/ft^3[5]	73	74	73	74	75	71	68	72	74	75	71
Average Bed Temperature, °F	1860	1852	1834	1841	1866	1829	1825	1486	1848	1828	1860
Overhead Gas Analysis, Wt %											
O_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	2.2	3.2	6.2	4.4	4.9	3.5	4.0	2.9	2.9	3.1	2.6
CO_2	29.4	27.6	26.3	28.5	27.6	27.6	29.4	28.5	28.5	29.0	29.4
N_2	68.5	69.2	67.5	67.1	67.5	68.8	66.6	68.6	69.5	68.0	68.0

(1) Determined by feeder rpm - dead-burned dolomite, rpm·359; dolomite, rpm·300; auxiliary fuel, rpm·346
(2) Determined by lift line pressure drop measurements
(3) Determined by weigh scale measurements
(4) Determined by orifice flow meter measurements
(5) Density indicated by pressure tap readings

Table 27-6. REGENERATOR DATA, RUN 27C (Sheet 3 of 3)

Run	27A	27A	27B	27B	27C	27C		27B	27C
Screen Size, Wt % Tyler Mesh	Char	Velva Lignite	Char	Velva Lignite	Char	Velva Lignite	Screen Size, Wt % Tyler Mesh	Dead-Burned	Tymochtee Dolomite
+8	0	0	0	0	0[1]	0[2]	+6		0
8 X 10	0.6	0.5	0.6	0.7	0.7	0.9	6 X 8	0	34.5
10 X 14	3.5	10.2	6.6	9.2	6.9	11.8	8 X 9	0.9	29.6
14 X 20	7.4	13.4	11.3	10.7	12.5	13.6	9 X 10	12.6	21.2
20 X 28	12.1	14.8	24.2	13.3	17.4	15.8	10 X 12	35.9	8.8
28 X 35	17.7	15.0	17.8	15.3	17.1	15.5	12 X 14	30.2	4.0
35 X 48	24.3	16.3	12.0	17.7	15.9	15.6	14 X 16	16.4	0.9
48 X 65	18.1	12.0	14.0	14.3	12.8	11.2	16 X 20	2.3	0.2
65 X 100	7.2	9.3	6.7	10.1	8.3	7.5	20 X 24	0.3	0.3
100 X 200	4.8	6.8	4.9	6.6	5.8	6.0	24 X 28	1.2	0.3
-200	4.3	1.7	1.9	2.1	2.3	2.3	-28	0.2	0.2
Moisture	4.4	1.5	3.3	2.8	3.7	4.3			
Ultimate Analysis, Wt %[3]									
C	71.17	66.10	71.24	64.08	72.3	62.89			
H	2.66	4.39	2.47	4.64	2.49	4.94			
S	1.59	0.56	1.78	0.58	1.63	0.65		0.02[5]	0.05[5]
Ash + SO_3	17.00	8.01	16.98	7.71	15.38	8.19			
Elemental Analysis, Wt %[4]									
SiO_2	36.82	23.48	39.62	28.28	30.44	32.16		2.22	6.25
SO_3	21.48	13.50	21.68	13.58	22.85	14.97		1.04	0.96
Na_2O	1.04	1.06	1.22	0.96	1.18	.88		0.04	0.05
CaO	21.66	38.64	19.65	30.88	23.93	29.14		57.78	52.65
MgO	5.24	10.68	5.30	8.74	7.98	7.98		36.53	37.52
K_2O	0.07	0.06	0.25	0.26	0.20	0.20		0.02	0.18
P_2O_5	0.04	0.19	0.04	0.26	0.04	0.19		0.02	0.02
Al_2O_3	7.57	10.64	7.52	11.13	8.60	10.04		1.37	1.57
Fe_2O_3	6.20	4.82	4.39	4.40	4.45	3.98		1.71	0.80
TiO_2	0.37	0.48	0.31	0.55	.47	0.50		0.25	0.10

(1)
(2) Average of eight screens
(3) Average of ten screens
(4) Dry basis
(5) As received
As sulfide

Table 27-7. FEEDSTOCK COMPOSITES

Date	← 7/4 →		← 7/5 →		7/6
Time	0845	2000	0800	2000	0800
Screen Size, Wt %					
Tyler Mesh					
+8	Tr		Tr		0.3
8 X 9	0.9	1.1		1.6	0.6
9 X 10	12.9		16.9		21.3
10 X 12	39.6	55.4	39.3	53.5	39.7
12 X 14	30.0		28.0		26.5
14 X 16	13.5		11.8		9.9
16 X 20	2.6	41.0	2.6	41.2	1.7
20 X 24	0.3		0.5		0.2
24 X 28	0.1	1.0	0.3	1.2	Tr
-28	Tr	1.4	0.7	2.6	Tr
Elemental Analysis, Wt %					
Total S	0.04		0.08		
SiO_2	0.97		1.09		
SO_3	0.11		0.16		

Table 27-8. CIRCULATED ACCEPTOR, CALCINED ACCEPTOR RETURN, RUN 27A

Date	7/4	← 7/5 →		7/6
Time	1210	0830	1600	1200
Screen Size, Wt % Tyler Mesh				
+9	0.6	Tr	0.8	3.4
9 X 10	9.0	8.6		13.1
10 X 12	35.5	37.6	49.3	30.3
12 X 14	35.8	29.6		31.4
14 X 16	15.5	21.5		15.3
16 X 20	2.6	2.3	48.3	3.2
20 X 24	0.9	0.2		2.0
24 X 28	0.1	0.1	1.4	0.7
-28	Tr	Tr	0.3	0.6
Particle Density, lb/cu ft				189
% Calcine Weight Change	-1.3	-1.6		
Elemental Analysis, Wt % Total S	0.04	0.08		0.05
SiO_2	1.08	1.09		2.84
SO_3	0.10	0.16		0.11

Table 27-9. CIRCULATED ACCEPTOR, RECARBONATED ACCEPTOR RETURN, RUN 27A

	Calcined Acceptor Return			Recarbonated Acceptor Return	
Date	← 7/20 →		7/21	← 7/21 →	
Time	0800	1600	0400	0001	0400
Screen Size, Wt % Tyler Mesh					
+8	0.1				
8 X 9	0.4	0.7	1.8	1.0	0.6
9 X 10	8.0				
10 X 12	37.5	48.1	55.5	50.4	45.4
12 X 14	33.5				
14 X 16	16.9				
16 X 20	3.0	50.4	41.9	48.3	52.9
20 X 24	0.3				
24 X 28	Tr	1.1	0.5	0.4	0.8
-28	0.2	Tr	0.3	-	0.2

Table 27-10. CIRCULATED ACCEPTOR, RUN 27B

Date	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10
Time	0800	0800	0800	0800	0800	0800	0800	0800	0810	0820	0800
Screen Size, Wt %											
Tyler Mesh											
+6		Tr		Tr	Tr	Tr	Tr	0.1			
6 X 8	Tr	1.2	5.4	7.6	12.1	14.4	12.8	10.4	12.8	15.1	9.0
8 X 9	0.7	0.8	7.8	10.6	14.6	19.2	18.4	18.7	18.5	19.8	15.1
9 X 10	13.4	22.9	21.1	29.4	25.8	25.0	26.4	21.8	20.6	18.9	19.7
10 X 12	35.9	38.9	29.2	23.4	19.4	17.6	17.6	15.6	14.7	14.0	14.9
12 X 14	29.2	25.9	22.3	17.3	13.3	11.1	11.5	11.9	11.7	11.2	13.0
14 X 16	16.3	8.6	8.4	4.5	4.5	4.6	5.4	6.2	6.3	5.7	6.9
16 X 20	2.9	1.1	1.7	2.2	2.9	3.0	3.0	4.5	4.5	4.2	4.9
20 X 24	0.5	0.3	0.7	1.3	1.7	1.5	1.5	2.5	2.5	2.4	3.0
24 X 28	0.2	Tr	0.6	1.3	1.7	1.5	1.3	2.3	2.4	2.3	3.5
-28	0.8	0.4	2.8	2.4	4.2	2.2	2.0	6.2	5.9	6.4	9.9
Elemental Analysis, Wt %											
Total S	0.05	0.04	0.07	0.1	0.11	0.05	0.1	0.09	0.11	0.11	0.09
SiO_2	0.61	1.22	3.84	6.75	6.41	5.56	1.89	4.05	8.64	8.18	12.68
SO_3	0.14	0.02	0.22	0.1	0.14	0.24	0.05	0.22	0.37	0.39	0.23

Table 27-11. CIRCULATED ACCEPTOR, CALCINED ACCEPTOR RETURN, RUN 27C

Date	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10	8/11
Time	0800	0830	0800	0800	0800	0800	0830	0800	0800	1600	0800	0800
Screen Size, Wt % Tyler Mesh												
+6	Tr	Tr										
6 X 8	Tr	Tr	4.0	8.9	7.5	9.5	11.1	9.3	11.6	11.3	10.8	7.4
8 X 9	Tr	Tr	6.1	13.5	14.9	18.8	20.6	18.9	20.0	25.3	20.5	14.0
9 X 10	16.3	17.0	22.5	30.1	29.2	28.0	25.3	25.4	23.2	20.9	18.9	19.5
10 X 12	34.9	35.9	30.0	22.8	22.9	20.3	18.2	19.1	17.3	15.2	16.1	21.1
12 X 14	30.8	30.9	26.0	17.4	16.2	13.0	11.8	13.4	13.4	11.5	13.0	17.7
14 X 16	15.3	14.1	9.1	4.4	4.9	5.4	5.7	6.7	6.3	6.0	6.9	9.5
16 X 20	2.4	1.8	1.8	1.7	2.6	2.9	3.3	3.6	4.0	4.2	4.1	5.0
20 X 24	0.3	0.2	0.4	0.8	1.1	1.3	1.8	1.7	2.0	2.6	3.8	2.3
24 X 28	0	Tr	0.1	0.4	0.5	0.8	0.9	1.1	1.3	1.8	2.6	1.8
-28	0	Tr	0.1		0.3	0.2	1.2	0.9	0.9	1.2	3.3	1.6
Particle Density, lb/cu ft					158	158	152	150	146	147	145	153
% Calcine Weight Change	-1.1	-0.6	-3.4	-8.6	-9.5	-9.6	-9.1	-9.8	-9.5	-9.3	-8.5	-8.56
Elemental Analysis, Wt % Total S	0.05	0.04	0.13	0.09	0.5	0.04		0.1	0.13	0.07	0.12	
SiO_2	0.69	1.38	3.1	3.43	4.9	7.72	9.74	7.28	6.9	8.25	6.7	5.43
SO_3	0.10	0.02	0.22	0.18	0.23	0.35	0.19	0.88	0.5	0.29	0.39	
Na_2O										0.05		
CaO										51.78		
MgO										34.85		
K_2O										0.04		
P_2O_5										0.03		
Al_2O_3										3.01		
Fe_2O_3										1.44		
TiO_2										0.29		

Table 27-12. CIRCULATED ACCEPTOR, RECARBONATED ACCEPTOR RETURN, RUN 27C

Date	← 7/4 →				← 7/5 →						7/6	
Time	1410		2000		0145		0700		2130		0745	
Sample	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor
Screen Size, Wt % Tyler Mesh												
+8		1.1	Tr	1.0			0.2	0.7	Tr	2.0		
8 X 9		1.4						0.8				1.0
9 X 10	1.8		2.6		2.7		5.0		3.5		5.1	
10 X 12		38.6		42.1		43.8		43.9		48.7		40.1
12 X 14	19.6	19.1	32.0	18.1	33.0	22.4	42.1	22.2	41.1	18.7	44.4	22.3
14 X 20	10.1	20.5	12.0	17.7	13.1	19.2	16.1	20.4	12.8	18.4	15.5	21.4
20 X 28	15.0	3.5	8.6	2.6	10.3	2.6	7.3	2.6	5.8	2.0	6.6	3.6
28 X 35	22.6	15.8	15.3	18.5	15.2	12.0	10.7	9.4	11.2	10.2	8.4	11.1
35 X 48	18.5		15.9		14.0		9.9		12.7		9.5	
48 X 65	8.1		7.9		6.4		4.6		6.9		5.1	
65 X 80												
80 X 100	3.7		4.4		4.0		2.9		4.4		3.8	
100 X 200	0.6		1.2		1.3		1.0		1.4		1.1	
-200	Tr		Tr		Tr		0.2		Tr		Tr	
% Char	67.8		52.6		47.8		36.2		37.3		38.9	
% Ash + SO_3	16.2		17.77		17.06		17.53		18.7		18.23	
Ash Elemental Analysis, Wt % SiO_2	24.7		23.62		24.98		29.46		30.14		27.48	
SO_3	9.07		10.25		3.97		1.54		8.12		3.17	

Table 27-13. REGENERATOR FUEL CHAR, RUN 27A

Date	← 7/20 →		7/21
Time	← 2210 →		0100
Sample	Mix	Acceptor	Mix
Screen Size, Wt % Tyler Mesh			
+9		1.0	
9 X 10	1.7		2.0
10 X 12		44.1	
12 X 14	22.0	21.1	30.2
14 X 20	11.4	17.2	14.6
20 X 28	11.2	1.8	12.5
28 X 35	14.3	15.0	14.8
35 X 48	15.2		13.4
48 X 65	9.9		6.6
65 X 80			
80 X 100	8.3		4.2
100 X 200	5.0		1.5
-200	0.8		0.1
% Char	68.47		
% Ash + SO_3	15.65		

Table 27-14. REGENERATOR FUEL CHAR, RUN 27B

Date	7/31		8/1		8/2		8/3		8/4		8/5	
Time	1720		1605		1600		1530		1650		1600	
Sample	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor
Screen Size, Wt % Tyler Mesh												
+8	Tr	1.1	0.1	Tr	2.0	3.8	2.6	5.5	4.7	5.1	4.6	10.9
8 X 9		1.1		1.1		7.2		13.0		17.4		25.1
9 X 10	2.4		2.1		9.5		15.0		24.2		22.3	
10 X 12		41.7		41.8		39.9		42.1		45.0		39.1
12 X 14	37.9	24.9	31.9	23.2	20.8	13.9	23.6	13.8	27.6	10.5	27.8	8.0
14 X 20	15.1	23.5	11.3	20.5	7.6	9.6	9.3	7.5	8.4	5.6	10.3	6.3
20 X 28	8.7	1.5	9.7	2.7	11.3	4.1	11.8	4.6	7.8	4.9	9.9	3.6
28 X 35	11.8		15.4		17.2		13.9		9.1		10.3	
35 X 48	11.3		15.2		17.0		12.8		9.3		8.6	
48 X 65	6.4	5.2	7.2	9.6	7.8	20.2	6.4	12.8	4.8	7.5	3.9	6.9
65 X 80						1.2		0.7				0.1
80 X 100	4.3		4.8		5.0		4.1		3.4		2.0	
100 X 200	1.9		2.0		1.7		0.6		0.7		0.2	
-200	0.1	1.0	0.2	1.1	Tr		Tr	Tr	0	1.1	Tr	Tr
% Char	48.4		52.5		55.9		47.0		28.3		31.8	
% Ash + SO_3	20.7		17.2		16.4		13.7		12.7		11.7	
Ash Elemental Analysis, Wt % SiO_2	29.2		26.7		21.3		18.4		19.6		20.1	
SO_3	12.1		2.1		3.9		1.9		2.1		3.0	

Table 27-15. REGENERATOR FUEL CHAR, RUN 27C (Sheet 1 of 2)

Date	8/6		8/7		8/8		8/9		8/10	
Time	1400		1915		1440		1540		1100	
Sample	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor
Screen Size, Wt % Tyler Mesh										
+8	3.3	8.0	6.4	10.3	3.9	7.3	3.2	10.1	3.1	8.2
8 X 9		22.4		18.5		12.6		12.6		15.8
9 X 10	21.5		22.7		17.2		10.5		13.8	
10 X 12		26.0		31.4		29.5		20.3		25.9
12 X 14	17.7	6.4	18.0	7.4	19.2	8.9	12.4	6.8	19.3	8.1
14 X 20	9.1	16.9	16.5	9.7	10.5	10.9	8.6	9.1	11.3	11.1
20 X 28	10.7	6.2	12.1	6.8	10.9	8.4	12.6	9.8	9.5	9.5
28 X 35	12.9		11.6		13.2		23.7		16.0	
35 X 48	12.8		7.0		13.9		15.3		15.1	
48 X 65	6.7	12.8	3.4	14.6	6.8	21.8	8.4	29.8	7.7	18.8
65 X 80		0.8				0.3		1.0		2.8
80 X 100	4.4		2.3		3.7		4.3		3.6	
100 X 200	0.9		0.5	0.8	0.7		0.8		0.6	
-200	Tr	0.3	Tr	0.2	Tr	0.3	0.1	0.5	Tr	0.4
% Char	41.0		43.2		39.8		51.6		41.6	
% Ash + SO_3	12.6		12.5		13.3		11.8		11.5	
Ash Elemental Analysis, Wt % SiO_2	20.6		18.6		20.8		17.1		17.9	
SO_3	2.1		2.0		2.4		2.06		2.3	

Table 27-15. REGENERATOR FUEL CHAR, RUN 27C (Sheet 2 of 2)

Date	← 7/4 →				← 7/5 →				7/6	
Time	1200		2000		1150		2000		0400	
Sample	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor
Screen Size, Wt % Tyler Mesh										
+8	Tr	1.1							Tr	
8 X 9		1.7				1.2		1.6		
9 X 10	2.5		1.8		3.2		2.4		3.8	
10 X 12		51.2		43.4		39.5		47.1		41.9
12 X 14	24.3	18.6	22.5	20.7	28.5	22.0	28.6	20.2	29.4	22.5
14 X 20	14.0	17.2	11.4	16.9	17.4	21.5	14.0	17.8	14.4	19.8
20 X 28	14.9	2.4	10.4	3.5	9.5	2.8	10.8	2.7	10.6	3.6
28 X 35	16.4	7.8	14.1	15.5	13.4	12.7	13.2	10.6	12.0	12.2
35 X 48	13.8		15.2		14.2		13.4		12.7	
48 X 65	7.2		10.6		8.3		7.9		7.2	
65 X 80										
80 X 100	4.5		8.6		6.3		6.4		6.0	
100 X 200	1.8		4.6		3.3		2.7		3.0	
-200	0.5		0.8		0.9		0.6		0.7	
% Char	59.4		64.8		50.7				49.3	
% Ash + SO_3	14.73		18.21		21.10				15.87	
Ash Elemental Analysis, Wt %										
SiO_2	20.70		24.67		26.69				25.83	
SO_3	12.06		4.39		5.36				3.22	

Table 27-16. GASIFIER CHAR BED MATERIAL, RUN 27A

Date	← 7/20 →		7/21
Time	← 2000 →		0400
Sample	Mix	Acceptor	Mix
Screen Size, Wt % Tyler Mesh			
+8	Tr		
8 X 9		0.8	
9 X 10	1.4		1.5
10 X 12		45.0	
12 X 14	19.0	25.2	24.3
14 X 20	12.7	18.2	14.2
20 X 28	14.3	1.7	14.4
28 X 35	16.2	9.1	15.4
35 X 48	15.5		14.2
48 X 65	9.1		7.6
65 X 80			
80 X 100	6.8		5.3
100 X 200	3.9		2.6
-200	1.2		0.4
% Char	68.8		
% Ash + SO_3	15.48		

Table 27-17. GASIFIER CHAR BED MATERIAL, RUN 27B

Date	7/31		← 8/1 →				← 8/2 →			
Time	2000		1200		2000		1230		2000	
Sample	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor
Screen Size, Wt % Tyler Mesh										
+8					0.8	3.1	1.7	5.9	2.5	5.7
8 X 9		4.1		0.7		3.1		6.3		10.8
9 X 10	2.7		3.7		3.8		9.1		8.7	
10 X 12		37.1		43.3		45.7		46.7		41.1
12 X 14	34.4	21.6	20.1	22.1	25.5	20.0	24.3	16.3	23.8	13.6
14 X 20	15.5	18.3	10.0	19.2	10.6	12.7	8.4	9.6	7.2	8.2
20 X 28	10.9	4.7	10.5	2.0	9.9	3.3	9.6	2.9	8.3	5.7
28 X 35	12.0		13.8		12.9		12.7		11.3	
35 X 48	11.0		14.9		14.0		13.2		13.4	
48 X 65	6.2	4.9	10.0	11.2	8.8	8.9	8.7	11.4	8.8	14.8
65 X 80		3.9		1.3		1.7		0.9		
80 X 100	4.7		9.0		7.7		7.3		8.9	
100 X 200	2.3		6.2		4.5		4.3		5.6	
-200	0.3	0.3	1.7	0.2	1.2	1.4	0.9		1.5	Tr
% Char	56.1		67.1		59.7		50.1		61.6	
% Ash + SO_3	15.9		17.3		16.6		16.6		18.0	
Ash Elemental Analysis, Wt % SiO_2	23.3		24.0		23.6		24.8		21.1	
SO_3	10.0		3.3		2.3		3.2		3.0	

Table 27-18. GASIFIER CHAR BED MATERIAL, RUN 27C (Sheet 1 of 4)

Date	← 8/3 →				← 8/4 →				8/5	
Time	1200		2000		1200		2000		1200	
Sample	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor
Screen Size, Wt % Tyler Mesh										
+8	4.3	4.6	2.9	5.8	5.0	6.6	3.9	12.6	3.4	7.6
8 X 9		11.5		14.0		16.3		17.2		15.7
9 X 10	16.7		13.4		21.4		15.0		15.2	
10 X 12		49.1		38.6		41.2		34.3		33.9
12 X 14	24.1	12.7	22.5	12.2	24.6	9.0	21.1	7.7	16.3	8.8
14 X 20	8.1	8.0	8.4	9.1	7.8	9.3	8.7	8.1	8.7	10.0
20 X 28	9.3	5.0	9.5	6.1	7.2	5.7	9.8	6.3	10.1	7.2
28 X 35	11.2		11.6		9.0		11.5		11.9	
35 X 48	11.6		12.6		10.1		12.5		13.0	
48 X 65	7.0	12.3	8.6	12.7	6.3	11.9	8.0	12.8	9.2	15.4
65 X 80		1.8		0.8		0.1		1.0		
80 X 100	5.7		7.1		5.5		6.5		8.0	
100 X 200	1.9		2.6		2.4		2.4		3.6	
-200	0.3		0.7	0.7	0.8	Tr	0.5	Tr	0.7	1.5
% Char	44.6		50.2		36.8		51.4		59.1	
% Ash + SO_3	15.5		12.8		15.3		12.13		15.4	
Ash Elemental Analysis, Wt % SiO_2	21.4		18.2		20.9		16.9		21.7	
SO_3	2.3		2.4		1.9		3.3		2.1	

Table 27-18. GASIFIER CHAR BED MATERIAL, RUN 27C (Sheet 2 of 4)

Date	8/5		← 8/6 →				← 8/7 →			
Time	2000		1200		2000		1200		200	
Sample	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor
Screen Size, Wt % Tyler Mesh										
+8	3.2	7.6	3.4	9.0	3.7	8.5	5.3	9.3	3.7	12.9
8 X 9		15.6		17.0		18.3		18.1		17.2
9 X 10	12.8		16.0		11.9		19.2		14.1	
10 X 12		32.6		28.7		30.2		30.8		25.8
12 X 14	16.7	9.0	16.6	8.2	17.1	7.5	16.7	8.3	17.1	7.3
14 X 20	9.9	10.2	8.8	10.6	7.2	9.4	9.0	9.1	8.6	10.1
20 X 28	11.4	6.9	9.6	7.9	9.7	7.2	9.4	6.7	9.2	7.1
28 X 35	12.9		12.0		12.0		11.0		10.9	
35 X 48	13.9		13.2		12.4		12.0		12.7	
48 X 65	8.6	16.4	8.4	17.0	10.4	17.4	7.6	16.6	8.7	18.3
65 X 80		1.1		1.2		1.2				
80 X 100	7.5		7.2		8.4		6.5		7.7	
100 X 200	2.7		3.5		4.5		2.6	0.9	4.7	1.3
-200	0.5	0.4	1.3	0.3	2.6	0.1	0.6	Tr	2.6	0.1
% Char	58.2		48.3		54.6		46.7		49.2	
% Ash + SO_3	14.3		15.0		15.8		15.5		16.9	
Ash Elemental Analysis, Wt % SiO_2	21.1		22.7		22.6		23.48		22.1	
SO_3	2.2		2.6		1.8		1.74		2.18	

Table 27-18. GASIFIER CHAR BED MATERIAL, RUN 27C (Sheet 3 of 4)

Date	← 8/8 →				← 8/9 →				8/10	
Time	1200		2000		1200		2000		1200	
Sample	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor	Mix	Acceptor
Screen Size, Wt % Tyler Mesh										
+8	5.4	8.1	3.6	9.8	4.8	9.9	3.3	9.5	5.4	8.2
8 X 9		17.0		15.7		15.5		14.4		15.8
9 X 10	16.5		12.5		15.0		11.9		17.5	
10 X 12		30.0		27.4		27.0		25.4		25.9
12 X 14	17.6	8.9	16.3	8.0	15.8	7.6	16.3	8.0	18.7	8.1
14 X 20	9.8	10.8	10.8	9.7	9.7	10.3	10.0	10.7	9.6	11.1
20 X 28	9.7	8.1	11.8	8.4	11.0	7.9	10.8	9.7	8.8	9.5
28 X 35	11.1		12.8		12.7		12.4		9.8	
35 X 48	11.9		13.5		13.0		12.7		11.4	
48 X 65	8.0	16.3	7.6	17.3	9.2	20.4	8.9	21.0	7.0	18.8
65 X 80		0.7		1.4				1.2		2.8
80 X 100	6.5		6.5		6.5		6.6		6.4	
100 X 200	2.8		3.0		2.1		4.0		3.7	
-200	0.7	Tr	1.7	2.4	0.3	1.1	3.1	Tr	1.7	0.4
% Char	43.7		49.7		44.4		47.0		38.5	
% Ash + SO_3	14.49		11.84		13.77		14.17		15.68	
Ash Elemental Analysis, Wt % SiO_2	23.27		20.69		19.98		21.24		20.06	
SO_3	2.37		1.91		1.74		2.01		2.47	

Table 27-18. GASIFIER CHAR BED MATERIAL, RUN 27C (Sheet 4 of 4)

Date	7/4	7/5	7/6
Time	Comp.	Comp.	Comp.
Screen Size, Wt %			
Tyler Mesh			
+60	1.4	1.3	1.1
60 X 100	3.9	15.4	52.6
100 X 325	40.5	57.3	27.5
-325	54.2	26.0	8.8
Ultimate Analysis, Wt %			
H_2O	← Dry →		
C	54.36	59.08	62.3
H	1.32	1.30	1.35
S	1.50	1.10	0.83
Ash + SO_3	36.62	31.38	28.35
Elemental Analysis, Wt %			
SiO_2	24.55	29.48	28.60
SO_3	10.15	8.33	7.20
Na_2O	1.08	1.07	1.04

Table 27-19. GASIFIER CHAR TO ORGANIC POND, RUN 27A

Date	7/21
Time	Comp.
Screen Size, Wt %	
Tyler Mesh	
+60	0.4
60 X 100	1.7
100 X 325	70.6
-325	27.3
Ultimate Analysis, Wt %	
H_2O	Dry
C	58.09
H	1.36
S	1.36
Ash + SO_3	32.82
Elemental Analysis, Wt %	
SiO_2	28.09
SO_3	9.82
Na_2O	1.07

Table 27-20. GASIFIER CHAR TO ORGANIC POND, RUN 27B

Date	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/9	8/10
Time	Comp.	Comp.	Comp.	Comp.	Comp.	Comp.	Comp.	Comp.	Comp.	1605	Comp.	Comp.
Screen Size, Wt %												
Tyler Mesh												
+60	0.1	3.4	0.7	8.1	15.6	5.0	0.4	36.5	47.6	42.8	44.4	44.9
60 X 100	3.0	16.5	8.7	37.2	29.7	18.3	12.3	36.6	24.4	27.6	21.7	24.6
100 X 325	78.5	50.6	67.2	45.8	40.3	48.9	46.4	20.3	18.9	21.5	25.4	21.9
-325	18.3	29.4	23.3	9.0	14.3	27.8	40.8	6.6	9.1	8.1	8.5	8.6
Ultimate Analysis, Wt %												
C		59.86	62.16	66.07	67.85	66.48	66.34	66.05	63.23	62.19	61.60	58.89
H		1.01	0.96	1.19	1.34	1.17	1.64	1.20	1.46	1.40	1.47	1.43
S		1.20	0.83	0.8	0.78	0.78	0.67	0.64	0.80	0.75	1.08	1.02
Ash + SO_3		30.67	27.92	24.62	22.38	23.38	24.61	25.36	27.17	26.75	28.16	24.7
Elemental Analysis, Wt %												
SiO_2		27.05	26.18	23.78	21.45	28.40	32.37	30.06	29.54	33.37	31.02	24.15
SO_3		9.72	6.81	8.21	8.54	8.01	1.66	6.19	7.23	6.79	9.26	9.83
Na_2O		1.00	1.00	0.97	0.96	0.98	1.07	1.13	0.99	0.92	0.94	1.02
CaO										37.18		
MgO										3.93		
K_2O										0.31		
P_2O_5										0.24		
Al_2O_3										11.76		
Fe_2O_3										5.65		
TiO_2										0.05		

Table 27-21. GASIFIER CHAR TO ORGANIC POND, RUN 27C

Date	7/5	← 7/6 →	
Time	1730	0140	0830
Screen Size, Wt % Tyler Mesh			
+35	1.0	0.7	1.1
35 X 48	15.9	6.1	5.4
48 X 65	28.3	12.1	11.4
65 X 100	24.1	15.5	13.0
100 X 200	15.7	22.5	19.6
200 X 325	5.2	15.3	12.7
-325	9.7	27.9	36.7
% Calcine Weight Change	-55.0		-9.5
Elemental Analysis, Wt %			
SiO_2	38.62		38.46
SO_3	12.10		2.94
Na_2O	1.02		1.27
CaO	23.20		29.56
MgO	8.66		9.76
K_2O	0.04		0.05
P_2O_5	0.04		0.11
Al_2O_3	9.84		13.33
Fe_2O_3	6.03		4.45
TiO_2	0.30		0.39

Table 27-22. ASH AND ATTRITED ACCEPTOR, RUN 27A

Date	← 7/21 →		
Time	0515	0930	2330
Screen Size, Wt % Tyler Mesh			
+35	1.8	1.0	
35 X 48	14.6	6.2	
48 X 65	20.4	11.5	
65 X 100	20.5	15.8	
100 X 200	14.7	21.5	
200 X 325	5.5	11.1	
-325	22.6	33.0	
% Calcine Weight Change			-36.0
Elemental Analysis, Wt %			
SiO_2			37.22
SO_3			5.46

Table 27-23. ASH AND ATTRITED ACCEPTOR, RUN 27B

Date	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10
Time	Comp.	Comp.	Comp.	Comp.	Comp.	Comp.	2340	Comp.	Comp.	Comp.	Comp.
Screen Size, Wt %											
Tyler Mesh											
+35	1.0	1.4	0.4	3.7	2.8	3.8	1.9	1.6	2.1	2.3	2.5
35 X 48	7.6	7.3	1.6	6.1	6.4	6.0	5.0	4.9	5.1	4.7	4.6
48 X 65	15.0	13.4	3.5	10.4	11.0	10.2	10.0	9.4	10.0	9.8	9.3
65 X 100	19.3	16.0	4.5	13.2	14.1	13.4	14.3	13.7	13.9	13.8	13.2
100 X 200	23.8	20.0	6.7	19.9	20.2	19.9	19.9	20.0	18.6	20.0	18.8
200 X 325	10.0	13.4	23.5	17.8	18.0	18.5	12.3	12.0	11.7	12.3	14.5
-325	23.3	28.4	59.8	28.9	27.5	28.2	36.6	38.4	28.6	37.1	37.0
% Calcine Weight Change	-9.7	-9.8	-6.8	-5.9	-6.0	-5.2	-4.4	-5.2	-1.9	-4.5	-5.6
Elemental Analysis, Wt %											
SiO_2	36.67	34.38	30.37	20.58	19.55	15.62	27.78	24.52	21.75	24.9	24.21
SO_3	2.95	2.94	5.52	3.46	5.96	7.18	4.13	5.72	7.48	5.59	4.49
Na_2O	1.30	1.34	0.86	0.91	1.01	0.72	0.86	0.80	0.78	0.82	0.82
CaO	30.86	32.17	32.44	41.28	40.05	42.75	37.32	36.66	38.69	38.0	38.83
MgO	10.89	12.02	15.92	20.71	19.58	20.85	16.84	16.83	17.26	18.01	18.96
K_2O	0.32	0.61	0.67	0.58	0.68	0.56	0.64	0.59	0.53	0.55	0.56
P_2O_5	0.11	0.11	0.06	0.08	0.11	0.13	0.10	0.11	0.10	0.10	0.07
Al_2O_3	12.48	11.54	9.38	8.90	9.77	8.98	9.02	11.46	9.97	8.77	8.96
Fe_2O_3	4.46	4.47	4.42	3.19	3.06	3.04	3.11	3.12	3.21	3.03	3.00
TiO_2	0.42	0.44	0.33	0.32	0.20	0.20	0.34	0.33	0.33	0.33	0.25

Table 27-24. ASH AND ATTRITED ACCEPTOR, RUN 27C

Date				8/3	← 8/5 →		← 8/6 →		← 8/7 →	
Time				0200	0215	1515	0825	1815	0120	1945
dPR-*	Chart	Zero	Range In. W.C.							
2030	-10/10	9.0	554.0	5.8	3.5	3.5	3.5	3.5	3.5	3.5
2089	0/100	4.2	25.0	10	10	11	11	10.5	10.5	10.5
2088	0/100	3.0	168.7	20.5	33	33	33	31.5	28	32
2087	0/100	3.0	43.7	31.5	64	65	67	70	69	65
2094	0/100	3.0	53.9	32	67	68	70	73	73	69
2093	0/100	3.0	115.4	28	36	36	37	37	37	35
2001	0/100	3.0	126.2	15	19	19.5	20	21	21	20
2002	0/100	3.0	57.1	36	35.5	35.5	35.5	35	35	35
2083	0/100	3.0	57.7	56	53	53.5	53	52	52	51
2019	0/100	4.2	300.0	30	27	28	30	28	33	24
2037	-10/10	9.0	40.0	-2.0	-2.0	-2.0	-2.0	-2	-2	-2
2021	0/100	4.2	50.0	72	70	72	75	74	74	74
2022	0/100	4.8	25.0	54	50	53	55	55	55	54
2073	0/100	3.0	150.0	37	35	35	34	34	34	33
2074	0/100	3.0	180.0	55	50	54	54	52	52	51
2075	0/100	3.0	180.0	62	59	59	58	58	58	58
2076	0/100	3.0	144.0	46	43	41	40	41	42	41
2077	0/100	3.0	144.0	22	22.5	16	15	16	20	18
2024	0/100	4.2	98.6	52	33	33	33	33	33	34
2025	0/100	4.2	300.0	40	25	27	27	28	27	28
2026	-10/10	9.0	40.0	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.6
2102	0/100	4.2	100.0	34	35	35	35	34	34	34
2020	0/100	4.2	300.0	54	56	62	62	63	69	58
2036	-10/10	9.0	100.0	-2.0	-1.8	-1.5	-1.8	-1.8	-1.8	-1.7
2028	0/100	4.8	50.0	56	59	60	63	66	66	63
2080	0/100	9.0	40.0	68	68	70	70	70	71	68

	Pressures, In. W.C.**						
Location*							
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	37.44	59.80	57.89	57.18	54.27	47.68	56.72
3	104.85	164.46	166.51	166.58	167.10	160.68	164.22
4	180.67	238.43	243.51	242.30	243.58	237.58	239.76
5	245.08	289.92	299.49	303.04	298.64	307.92	283.42
6	240.89	286.00	295.45	299.09	294.67	303.93	279.40
7	191.76	235.32	244.41	244.92	241.27	250.79	226.92
8	139.29	180.68	191.27	192.14	188.74	198.54	176.51
9	-133.51	-70.29	-73.75	-72.85	-75.41	-71.28	-78.36
10	-165.66	-102.70	-98.05	-96.00	-100.14	-102.36	-105.23
11	3.07	3.11	3.00	2.96	2.94	2.90	3.23
12	66.40	91.89	89.08	89.06	84.94	78.22	87.06
13	188.40	228.52	239.79	242.98	241.22	251.62	226.55
14	178.89	219.36	232.36	233.88	232.16	242.61	218.10
15	146.54	187.46	199.05	199.76	196.39	206.63	183.45

*Refer to Figure 5.

**Static pressure at Location 1 is 150 psig. Pressures listed are differential pressures from Location 1.

Table 27-25. PRESSURE BALANCE TESTS, RUN 27C (Sheet 1 of 2)

Date				← 8/9 →					← 8/10 →		
Time				0130	0730	1030	1530	2145	0130	0930	1330
dPR-*	Chart	Zero	Range In. W.C.								
2030	-10/10	9.0	554.0	3	2.9	3.0	3	2.8	2.8	2.9	2.9
2089	0/100	4.2	25.0	11	10.5	11	11	11	11	11	11
2088	0/100	3.0	168.7	32	33	32.5	32	24.5	22	32	36
2087	0/100	3.0	43.7	62	63	64	69	71.5	70	69	72
2094	0/100	3.0	53.9	65	67	68	71	76	75	73	77
2093	0/100	3.0	115.4	33	33.5	34	36	38	36.5	36.5	38.5
2001	0/100	3.0	126.2	18	19	20	20	22	22	21	23
2002	0/100	3.0	57.1	35	35	35	35	35	35	35	35
2083	0/100	3.0	57.7	50	51	51	50	50	51	50	51
2019	0/100	4.2	300.0	27	28	25	30	36	38	35	23
2037	-10/19	9.0	40.0	-2	-2	-2	-2	-1.9	-2	-2	-2
2021	0/100	4.2	50.0	70	73	75	78	81	78	80	77
2022	0/100	4.8	25.0	50	53	55	60	63	57	59	54
2073	0/100	3.0	150.0	32	32	32	33	33	33	32	33
2074	0/100	3.0	180.0	50	49	49	50	50	52	52	52
2075	0/100	3.0	180.0	57	55	56	55	58	59	58	57
2076	0/100	3.0	144.0	39	37	37	38	40	40	39	35
2077	0/100	3.0	144.0	17	13	12	14	16	17	15	11
2024	0/100	4.2	98.6	30	31	31	30	29	30	30	31
2025	0/100	4.2	300.0	23	23	24	23	23	23	23	24
2026	-10/10	9.0	40.0	-1.8	-1.5	-1.5	-2	-1.8	-1.8	-1.5	-1.5
2102	0/100	4.2	100.0	32	32	32	32	32	32	32	32
2020	0/100	4.2	300.0	60	56	56	65	71	75	69	61
2036	-10/10	9.0	100.0	-1	-1	-1.0	-1	-1.0	-1	-1	-1
2028	0/100	4.8	50.0	57	59	60	68	71	70	69	70
2080	0/100	9.0	40.0	68	68	67.5	72	71	72	70	70

	Pressures, In. W.C.**							
Location*								
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	57.56	59.29	58.02	55.30	43.05	38.76	54.52	62.21
3	160.38	158.95	162.50	166.84	159.23	153.05	166.52	180.19
4	233.60	230.26	237.41	241.83	235.78	230.87	241.96	258.88
5	286.89	283.76	283.70	303.61	314.65	316.46	318.00	299.19
6	282.82	279.90	279.71	299.58	310.88	312.46	314.03	295.21
7	233.88	226.07	226.03	243.60	251.89	256.98	256.64	240.74
8	185.50	175.18	176.70	193.20	200.85	206.39	207.20	189.90
9	-59.77	-61.48	-63.97	-57.04	-56.76	-57.50	-57.21	-62.17
10	-84.89	-80.94	-82.19	-78.81	-81.36	-83.63	-80.77	-79.47
11	3.68	3.08	3.05	3.93	3.55	3.54	2.91	2.96
12	85.59	79.48	86.62	83.64	71.74	67.18	83.18	90.82
13	229.42	218.37	221.27	243.94	252.19	258.01	257.25	240.49
14	224.50	213.19	216.25	238.97	247.15	253.02	252.22	235.47
15	192.52	181.84	183.39	201.75	208.89	214.91	214.87	197.58

*Refer to Figure 5.
**Static pressure at Location 1 is 150 psig. Pressures listed are differential pressures from Location 1.

Table 27-25. PRESSURE BALANCE TESTS, RUN 27C (Sheet 2 of 2)

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